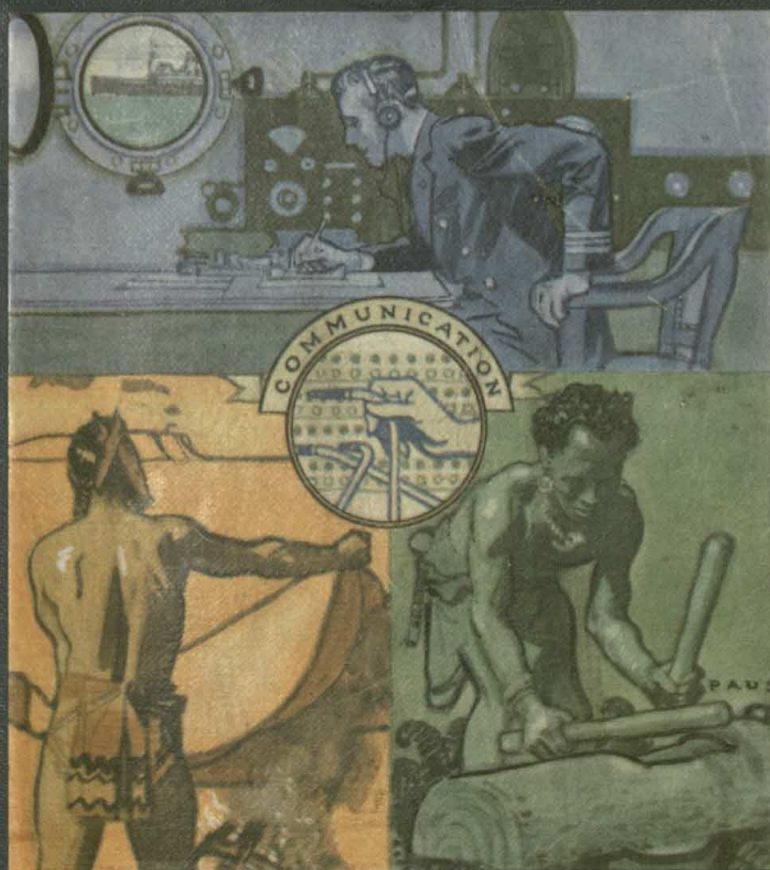


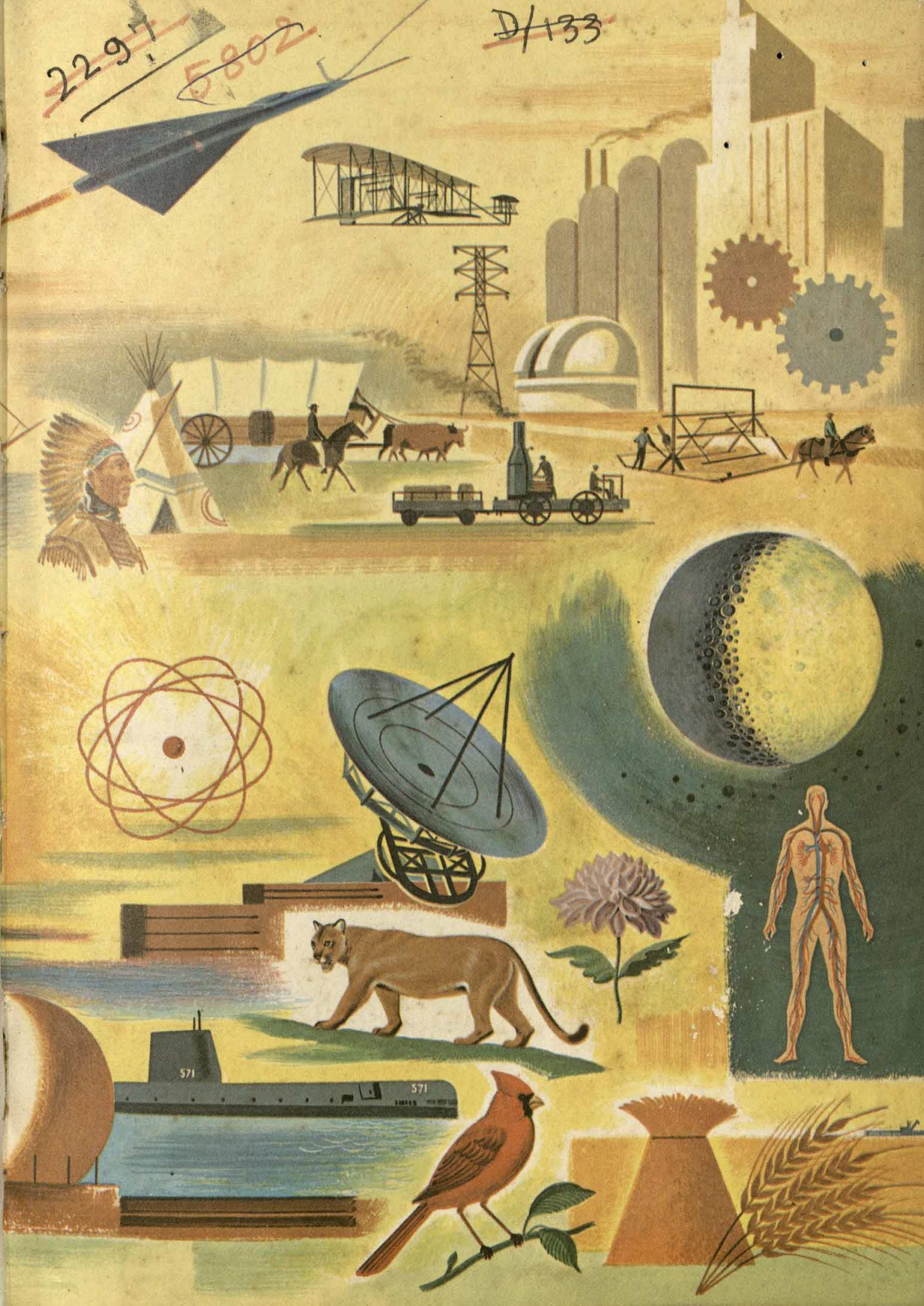
THE WONDERLAND OF KNOWLEDGE





~~2297~~
~~5802~~

~~D/133~~



2297

1133

THE WONDERLAND OF KNOWLEDGE



The Pictorial Encyclopedia



Editor in Chief—EVERETTE EDGAR SENTMAN
B.S., University of Illinois; Drake U., Loyola U., American Conservatory
Writer, Lecturer; Author, "The Encyclopedia—A Key to Effective Learning and Teaching"

Former Editors in Chief—GORDON J. LAING
Ph.D., LL.D., Litt.D.
Former Dean, Division of Humanities, University of Chicago

HARRY ORRIN GILLET
B.S., University of Chicago
Former Supervisor of Education, Museum of Science and Industry, Chicago
Principal Emeritus of the University of Chicago Laboratory School

Managing Editor—ASHER J. BIRNBAUM
Ph.B., University of Chicago; B.A., Northwestern U.

Associate Editors—RODERICK M. GRANT
A.B., Beloit College
Managing Editor, *Popular Mechanics*

VALETA WISURI
A.B., LL.B., Washington University

Science Editor—ELIZABETH R. JOHNSON
B.S., St. Ambrose College; Former Control Laboratory Analyst, Abbott Laboratories;
Patent Abstracter, Internatl. Minerals and Chemical Corp.

Art Director—RICHARD K. GORSKI
M.S., University of Wisconsin
Art Education Specialist

Picture Editors—JAMES POYNTON
Ph.B., Loyola University

RALPH W. MILLER
Ph.B., University of Chicago; Formerly of International News Photos

Production Manager—CROSBY J. LISKE
Graduate, Art Institute of Chicago

Director of Educational Research and Services—VICTORIA S. JOHNSON
Special Studies, Northwestern University, American Conservatory
Assistant Director, The Chicago Tribune Miracle of Books



WONDERLAND OF KNOWLEDGE CORPORATION

THE BOARD OF EDUCATORS

This distinguished advisory body enriches The Wonderland with sound educational techniques, important facts, and significant meanings.

SELMER H. BERG, M.A.
Superintendent of Schools
Oakland, California

FRANCIS KEPPEL, B.A.
Dean of Graduate School of Education
Harvard University

KARL BERNHARDT, Ph.D.
Professor of Psychology and
Assistant Director, Institute for Child Study,
University of Toronto

E. T. McSWAIN, Ed.D.
Dean and Professor of Education
School of Education
Northwestern University

A. J. BRUMBAUGH, Ph.D., LL.D., L.H.D.
Consultant for Research, Southern Regional
Education Board, Atlanta; Formerly Dean,
University of Chicago; Director, Programs
Branch, U. S. Office of Education

WILLIAM VAN TIL, Ph.D.
Chairman of Department of
Secondary Education, Professor of
Education, New York University

Chairman
CAREY CRONEIS, D.Sc., Ph.D., D.Eng.
Provost of William Marsh Rice University,
Houston, Texas;
Formerly President, Beloit College

PRONUNCIATION

The pronunciation of titles is indicated by accenting the word or by respelling it phonetically in italics. In the phonetic spelling, letters are used to indicate the sounds which they most commonly represent.

A vowel is *short* when followed by a consonant in the same syllable, unless the syllable ends in silent *e*.

A vowel is *long* when the letter occurs in a syllable which ends in silent *e* or when ending an accented syllable.

The hard sound of *c* is represented by *k*.

The hard sound of *s* is represented by *z*.

The foreign sounds which have no equivalent in the English language are represented as follows:

N for the French *n*, as in Breton: (**Breton**, *bre toN'*).

ö for the German *ö*, as in Göttingen: (**Göttingen**, *gö' ting en*).

ü for the German *ü*, as in Blücher: (**Blücher**, *blük'ur*).

Copyright© 1937, 1940, 1942, 1944, 1945, 1946, 1949, 1950, 1951,
1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961

PUBLISHERS PRODUCTIONS, INC.
Tangley Oaks Educational Center
Lake Bluff, Illinois

Printed in the United States of America

Library of Congress Catalog Card Number: 61-5907



A Wonderland
PICTURE STORY
Volume X



Smith and Wesson Collection

PIRACY. In the seventeenth century, pirates, like the swashbuckling Captain Kidd, preyed upon the Spanish treasure ships homeward bound from the Spanish Main. See page 2766.

Highlights of

Volume X

How important was pepper to the people of early times?

Pepper was such a valuable commodity in ancient Rome that when Alaric the Visigoth demanded ransom after conquering the city in 410, he accepted as a large part of the ransom a ton and a half of pepper. See PEPPER.

Why is the reign of King Philip II of Spain significant in European history?

It was during these years of the sixteenth century that Spain both gained and lost one of the world's greatest empires. Philip's policies reduced his country from the position of the ranking world power to one of comparative insignificance in European affairs. See PHILIP II.

How did an attempt to dodge the slavery issue almost bring war with Spain in 1854?

Through the efforts of the pro-slavery group, which wanted public attention diverted from the slavery question, the Ostend Manifesto was drawn up, threatening Spain with the seizure of Cuba unless she sold her island possession to the United States. Fortunately, no action was taken. See PIERCE, FRANKLIN.

Is it true that fountain pens are made of milk?

Milk certainly is the chief contributing factor. When one of the principal derivatives of milk, casein, is joined with the chemical compound formaldehyde, a very hard material is formed which is used as the "shell" of fountain pens. It may take beautiful colors. See PLASTICS.

Why is the metal platinum, alloyed with iridium, used for the international standards of length and weight?

The standards of yard and meter, pound and kilogram, preserved by the governments, are made of a platinum-iridium alloy because this combination is unaffected by changes in temperature or atmosphere. See PLATINUM.

How did Florida get its name?

Ponce de Leon is said to have landed in what is now Florida on Easter Sunday, 1513. The Spanish term for Easter is *Pascua Florida*, "Feast of the Flowers," and Ponce de Leon named the land in its honor. See PONCE DE LEON.

What provisions have been made by the United States for the independence of Puerto Rico?

If the islanders ever agree on the matter of an independent government, the United States will grant them independence. However, at present there are three factions, one desiring independence, a second wanting admission as a state, and the third content with the present setup. See PUERTO RICO.

What plan of reconstruction might have been followed had Lincoln lived?

Lincoln believed he had the power to pardon the states of the Confederacy and readmit them to their former status as members of the United States as soon as they had chosen loyal officers. Quite an opposite policy, one of great injustice, was carried out by Congress. See RECONSTRUCTION.

How did Walter Reed, a United States Army doctor, benefit the people of the tropics?

Sent to Cuba in 1900 to investigate the cause of yellow fever, Dr. Reed and his associates proved that the deadly tropical disease is spread by the *Aedes aegypti* mosquito and then went on to show that the disease can be wiped out by destroying the carriers. See REED, WALTER.

Were the American colonies unanimously set on independence at the outbreak of the Revolutionary War in 1775?

Not in the least. In fact, never, during the war, was there a popular uprising. Almost 100,000 colonists, loyal to England, left the country, and half of the others did not know whether they wanted to remain under British rule or not. See REVOLUTIONARY WAR IN AMERICA.

What President of the United States was awarded a Nobel Peace Prize during his term of office?

In 1905 President Theodore Roosevelt brought the Russo-Japanese War to an end by persuading representatives of the two countries to sign a peace treaty at Portsmouth, N. H. For this achievement, the following year, he was given the Nobel award. See ROOSEVELT, THEODORE.

How did rubber get its name?

The English chemist, Priestley, made the first practical use of the elastic substance by erasing pencil marks with it. Because of this power to "rub" away, the substance received its name. See RUBBER.



Virginia State Chamber of Commerce

PICKING PEACHES FOR MARKET

Workers harvest the crop in a Virginia orchard.

PEACH. One of the most commercially valuable of all fruits, the beautiful peach is noted for its delicate, delicious flavor. It is thought to be a native of China, where it has been cultivated for thousands of years. The United States is now the world's leading producer, raising millions of bushels yearly. Although California leads in production, Georgia, Arkansas, Michigan, and various other states are noted for their peaches. They are also widely grown in Canada, especially in Ontario and British Columbia. Used fresh, canned, dried, spiced, or as preserves, peaches are extremely popular.

The peach is related to the plum and other stone fruits. The tree is a member of the rose family and seldom grows more than twenty-five feet high. It produces long, slender leaves and bears gorgeous

blossoms early in the spring. The fruit is divided into two general classes, the cling-stone and freestone, but the division is not easily distinguishable in certain varieties, and some varieties have the characteristics of both groups at certain times.

The 300 varieties of peaches grown in North America are classified into five general types. The Peen-to, or flat, peach is a small greenish fruit cultivated in the Southern states; the South China is a small, oval fruit; the Spanish, or Indian, type is a late fruit with a yellow, hairy skin; the North China is large and oval; and the Persian includes almost all the large yellow- or white-fleshed varieties grown in the temperate areas. Nectarines are a smooth-skinned variation of the peach.

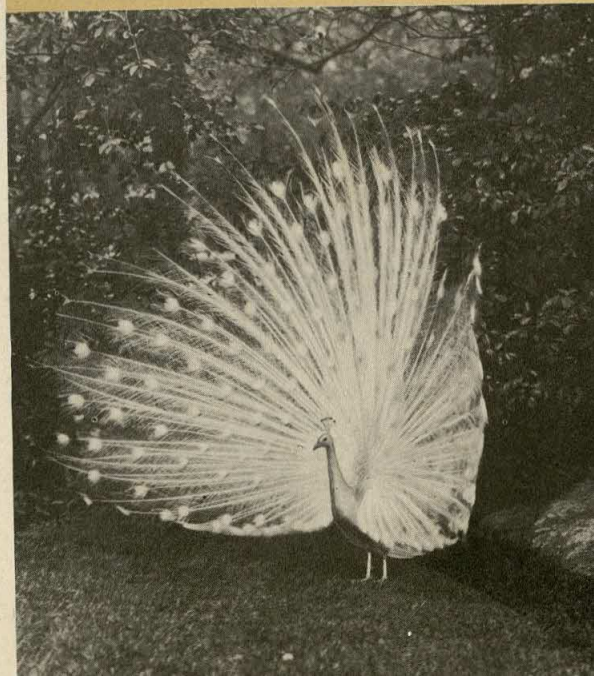
Peach trees are grown in nurseries from seeds planted in the spring in pits six to eight inches deep. During the latter part of the summer the desired varieties of peaches are grafted onto the seedling, since peach trees seldom reproduce true to seed. The seedlings are then transferred to the orchard.

PEA'COCK. The brilliant hues of its great fan-shaped tail have made the peacock a much admired and decorative pet.

New York Zoological Society Photo

FEATHERED SHOW-OFF

The Indian, or white, peacock spreads his tail.





NITROGEN GATHERER

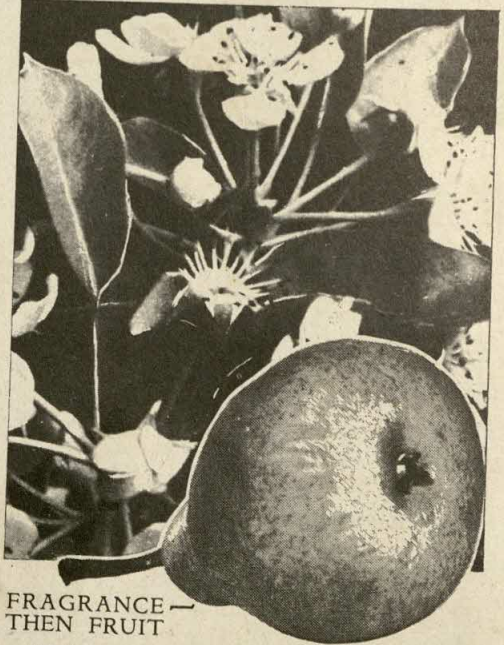
Peanut roots grow nitrogen-collecting nodules.

The bird is the male of the peafowl and a member of the pheasant family. It is about as large as the domestic turkey but has a smaller head, which is surmounted by a feathery crest. Its colors are harmoniously combined, with deep blues and bright greens predominating. The long tail feathers, marked with eyelike spots, can be spread into a fan. The peacock's harsh voice was probably developed as a protective means in jungle life. The bird is native to India, Ceylon, Burma, Malaysia, and Java, but has been taken to all parts of the world.

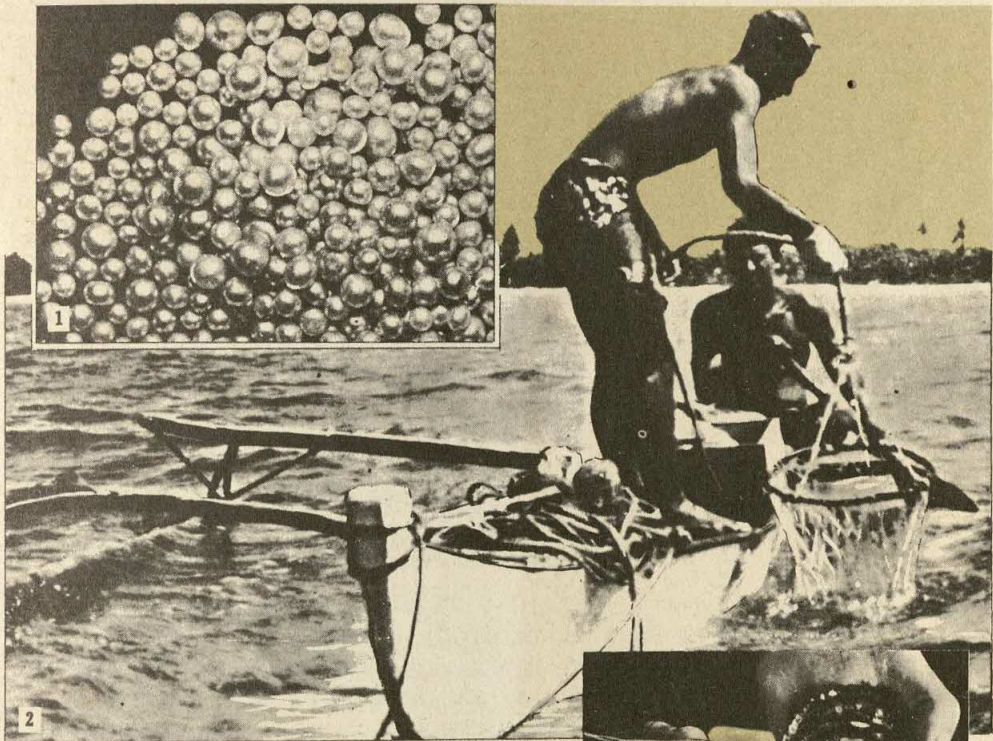
PEALE, peel, CHARLES WILLSON (1741-1827). Several of the finest portraits of George Washington are the work of this famous American painter. Charles Peale studied under Copley in Boston and under Benjamin West in London. In addition to fourteen portraits of Washington, he executed portraits of Nathanael Green, Horatio Gates, Benjamin Franklin, Thomas Jefferson, and many other famous people.

PEANUT, or GOO'BER. One of our most popular foods, the peanut is a small "nut" of the pea family. It is not a true nut, but a legume. The annual crop of the United States amounts to more than a billion pounds. The principal growing centers are Texas, Alabama, Georgia, North Carolina, Virginia, and Florida. The peanut is a native of South America and is widely grown in warm regions.

Peanuts are planted in late spring after the last frosts. The plant, which is of either the bunch or runner type, has a hairy stem and produces many branches on which are borne small yellow flowers. When the flowers fall off, the stem bends down and forces the pods into the ground, where the peanuts ripen. Roasted and salted, peanuts are a favorite delicacy, and they are also the source of oil used in cooking, in soap, and in certain types of health diets. Peanut butter, which is made of peanuts finely crushed into an oily mass, has high protein value and is occasionally used as a meat substitute.

FRAGRANCE—
THEN FRUIT

PEAR. A smooth-coated fruit, the pear is a delicious fruit, much prized both fresh and canned. Belonging to the same family



“WHO WOULD FIND PEARLS
MUST DIVE BELOW”

In the seas of the tropics, native divers glean a precarious livelihood by harvesting the oyster beds. (1) Trader's collection of Oriental pearls. (2) Native divers on lagoon preserve. (3) Happy end of a treasure hunt.

as the peach, apple, and plum, the pear is an irregular, cone-shaped fruit. The seeds are in a core in the center, and hard, bumpy, wood cells are scattered through the pulp.

The pear is a valuable commercial fruit in the United States, where the annual yield is about 30,000,000 bushels valued at \$68,250,000. The principal pear states are California, New York, Washington, Oregon, Michigan, and New Jersey. Italy and France are, in normal times, important pear-raising countries.

The pear tree is somewhat smaller than the apple tree and is of two varieties—the standard and the dwarf. As in the case of the peach, the tree is grown from grafting the desired varieties on the small seedlings. Dwarf trees are grown by grafting onto

quince stock, and have the advantage of bearing early and heavily. There are many varieties of pears, but the favorites are the Bartlett, Anjou, Le Conte, and Kieffer. The fruit is picked when green and allowed to ripen slowly.

PEARL, *purl*. Treasured for their whiteness, their luster, and their smoothness, pearls are among the most beautiful of gems. Not all pearls, however, are white; some are black, blue, gray, purple, yellow, or pink. Unlike diamonds, rubies, emeralds, and other glittering jewels, the pearl is the product of certain species of mollusks, or shellfish.

Not all mollusks create pearls, although all shell-covered animals exude the material, called *nacre*, or *mother-of-pearl*, which makes the gem. The pearl occurs only



ARCTIC PIONEER: PEARY AT THE POLE

On his eighth Polar exploration trip, Rear Admiral Peary finally reached the North Pole. There he planted five flags, one of which was his "farthest north" American standard.

when a grain of sand or some foreign substance enters the shell and irritates the soft body. The animal, unable to move the object, then covers it with layers of the milky, filmy substance. These layers harden in the form of a sphere, forming a smooth pearl. Sometimes they form in the shape of a pear, or of a hemisphere, but no matter what the shape, the pearl must be symmetrical or its worth declines. The larger the pearl, the higher the value.

Large oysters and giant clams are the chief producers of pearls, and the finest come from the pearl oysters of the Persian Gulf. Other excellent pearls are taken from oysters off the coasts of Lower California, Australia, Ceylon, and Panama. These oysters are found at a depth of 50 to 100 feet, most often where there are strong currents, as in the channels between islands. Divers descend to the bottom and bring up the oysters to the waiting boats. The oysters, when brought to shore, are left to decompose. Then the pearls are easily removed.

The mother-of-pearl substance found in all mollusks is used for buttons, handles, and other small articles. Pink mother-of-pearl from the West Indies is used for cameos; abalone shells from the Lower California coasts are used for inlays.

PEARY, *peer'i*, ROBERT EDWIN (1856-1920). Honored by scientific societies all over the world because of his Arctic explorations, Robert E. Peary reached the peak of his fame with the discovery of the North Pole on April 6, 1909. Born at Crescon, Penna., and educated at Bowdoin College, in Maine, the explorer became a civil engineer in the United States Navy in 1881 and made surveys for the proposed Nicaragua Canal. He made expeditions to the Arctic regions in 1891, 1893-95, and 1896-97, which he recounted in 1898 in his book, *Northward Over the Great Ice*.

At that time he had reached the most northerly point ever attained. Another trip in 1905 resulted in a second book, *Near-est the Pole*. In 1908 Peary began the trip that was to bring him lasting fame. After his return, the explorer was acclaimed by Congress and given the rank of rear admiral in the navy. His books published after his greatest journey were *The North Pole* and *Secrets of Polar Travel*.

PEAT, *peat*. In some parts of the world, peat, instead of wood or coal, is used for fuel. Produced by the slow decay of vegetable matter, it is found in damp places called peat bogs. It is sometimes referred to as coal in the making.

Mosses cover the fallen trees, twigs, and other plant life, growing for centuries until they have become completely enmeshed in the vegetable matter. They form closely woven mats, with those mosses at the bottom gradually dying. In time the mass becomes compact.

It is customary to prepare peat for fuel by digging it from the bogs and cutting it into bricks for drying. In some places peat is ground and washed to remove dirt and clay. The pure peat is run into beds at a depth of about four inches and allowed to dry partially, when it is cut into blocks and dried thoroughly. Peat makes an excellent fuel when free from impurities and completely dry, but it is not in general use where coal is obtainable.

There are extensive peat bogs in Europe, particularly in Ireland, Russia, the Scandinavian countries, France, and Germany. In Ireland, particularly, peat is widely used.

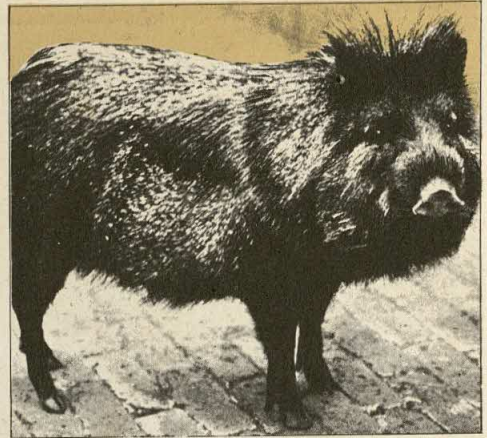
Canada ranks very high in peat resources. Other large deposits are found in Alaska and in the United States, especially in Minnesota, but also in the other Central states and in the Atlantic states from New Jersey to Florida. See COAL; FUEL.



BEST-SELLING NUT

Pecans are the basis of a thriving industry.

PECAN, *pe kan'* or *pe kahn'*. This valuable, long-lived nut tree is a species of hickory that may reach a height of over 150 feet. Its wood has little value. Some pecans have very hard shells, but those of the preferred paper-shells are easily broken. Millions of pounds of pecans are gathered in the United States yearly. Most of these come from wild trees, but the production of cultivated varieties is an important and rapidly increasing industry. Texas, Georgia, Oklahoma, and the other Southern states



PORKER OF THE WILDS

The collared peccary, or musk hog, usually timid, fights viciously when cornered.

are the leading producers of cultivated pecans. See HICKORY.

PECCARY, *pek' a rih*. Related to the wild hogs, the blackish *collared peccary* lives chiefly among dense, river-bottom thickets, but also in deserts. It is found in many parts of South America and as far north as Texas and Southern New Mexico and Arizona. The larger, darker *white-lipped peccary* dwells in forested Central and South America. Both have bristly hair, a large scent gland on the back, and down-pointing tusks. Their food includes roots, nuts, insects, toads, and snakes. Most "pigskin" articles are made from peccary hide. The animals are also hunted for sport and for their meat.

PEEL, ROBERT, SIR (1788-1850). From 1834 to 1835 and from 1841 to 1846, Robert Peel was Prime Minister of England. As a member of Parliament, and as Secretary for Ireland from 1812 to 1818, he opposed Irish Home Rule and Roman Catholic emancipation, coming into conflict with the Irish patriot, O'Connell. In 1829, however, while Home Secretary, he supported the Emancipation Act. He was the original sponsor of the famous London police, who are still popularly known as "Peelers" and "Bobbies." During his second term of office as Premier, Peel supported free trade and the repeal of the corn laws.

PEER. Although this word means *equal*, it is used in different ways in the United States and England. American law gives every man who is accused of a crime the right to a trial by a jury of his peers; that is, by his equals or fellow citizens.

In England the term refers to titled noblemen who are equal in that each is entitled to a seat in the House of Lords.



Ewing Galloway

ANCIENT CAPITAL ENTRANCE
Jinrikishas at a gate of historic Peiping.

PEIPING, *bay ping'*, or **PEKING'**, CHINA. Located about 100 miles northwest of the Gulf of Pohai and a few miles west of the Pei River, Peiping was for more than three centuries the seat of the old Manchu government of China, and is today one of the oldest and strangest cities in the civilized world. It is called both Peiping and Peking. Under the early Ming rulers (fourteenth century), the name Peiping was used, but later emperors of the Ming and Manchu dynasties called the city Peking, a name it retained as capital of the Chinese Republic from 1911 to 1928. Shortly after the city's capture in 1928 by Chinese Nationalist armies, it was renamed Peiping. Nanking was made the Nationalist capital (moved to Chungking during the war with Japan). The Japanese captured Peiping

in 1937, and held the city until 1945, when they were forced to surrender to the Allies in World War II.

The city lies in Hopeh province about seventy miles southeast of the Great Wall of China. When the city's defenses crumbled before the invading Japanese in 1937, it was protected by walls thirty feet high. Sixteen gates lead into the city from every direction. Extending east and west through Peiping is a wall dividing the city into two parts: the Tatar, or Inner, City and the Chinese, or Outer, City.

In the Tatar City, entered by several gates from the Chinese City, are the foreign embassies. Two rectangular walls, one within the other, divide the Tatar city into three distinct parts. The larger of the two surrounds the Imperial City, and the central area is called the Inner, or Forbidden, City. The outer portion is the residential and business area, while the central Imperial City is dotted with parks, temples, and government buildings. Until the founding of the republic, the Forbidden City was closed to foreigners. It contained the palace with its beautiful surrounding gardens and grounds.

The Chinese city, occupying about half of Peiping, is by no means modern, bicycle rickshas being the favored transportation. Automobiles are seldom seen, although there has been some street building.

Peiping is now the capital of Communist China and has a population of about 4,140,000. The "People's Republic of China," the Communist government of Mao Tse-Tung, was proclaimed in the city on September 21, 1949. His forces had been victorious in the civil war against Nationalist leader Chiang Kai-shek.

Communist economic projects have been directed from Peiping. Chinese leaders are working to give the country an industrial economy centered in the city. See CHINA; CHINESE-JAPANESE WARS.

PEKING. See PEIPING.

PELICAN. With its great pouch of naked skin on the underside of its long, broad bill, the pelican is a strange-looking



BIG BILL

The comical pelican is smarter than he looks.

bird. One species, the *brown* pelican, is a sea bird found off the southern coasts of North America to South America; a second, the *white* pelican, is found in Western United States northward to British Columbia and Great Slave Lake. It winters in the Southern states and south to Central America. This is one of the largest American birds, and one of the greatest in size of the web-footed birds. It often weighs sixteen pounds or more, and has a wingspread of eight to nearly ten feet.

Pelicans often feed in flocks, eating fish

which they have caught and stored in their pouches. They nest in great colonies, especially on islands, and in Florida the government has set aside a refuge for them, known as Pelican Island. The young birds feed by reaching into the throat of the parent for partially digested food. Pelicans are clumsy on land, but are fine swimmers and are strong on the wing.

PELOPONNESIAN, *pel o pon e' shan*, **WAR.** See GREECE.

PELOPONNE'SUS. Divided into six states during ancient times, the Peloponne-

sus is the long peninsula which comprises Southern Greece, now called Morea. The ancient states were Messenia, Argolis, Laconia (Sparta), Elis, Arcadia, and Achaea. See GREECE.

PEMMICAN, *pem'i kan*. 'This North American Indian food is still used by Eskimos and by many explorers.

Pemmican is usually made of lean meat, which is dried and pounded into a powder. Boiling hot fat is then mixed with it. When the whole is cooled, it is pressed into cakes. Sometimes, dried berries and other fruits are mixed with the ground meat to add a touch of flavor. Deer meat, buffalo meat, beef, or meat from other animals may be made into pemmican. It is a compact, nutritious food, and remains edible a long time.

PEN. Ever since man learned to write, some sort of pen has been used. At first it was no more than a sharp instrument for carving out figures on stone. Today, it is a fine steel or gold point which fits into a holder and is made into a variety of shapes and sizes to suit the individual's needs and style.

The Romans used a metal stylus with a stiff point for writing on tablets coated with wax. After the development of paper and ink, the feathers of birds, or quills, came into use. In fact, the word *pen* comes from the Latin term for *feather*. Quills were dried in hot sand and sharpened with a knife. This type of writing instrument was used until the nineteenth century. The Declaration of Independence was written and signed by means of carefully prepared quill pens.

The practical manufacture of machine-made steel pens was begun in England between 1820 and 1830. One of the group who perfected the form of the pen point was Joseph Gillott.

Gold pens are better than steel because of their durability and flexibility. They usually have hard, iridium-tipped points and are commonly used in fountain pens. The fountain pen is a convenient device which stores ink in a tube and feeds it

to the point. The ballpoint fountain pen has a tiny, revolving steel ball instead of a point. When used, its special, jelly-like ink flows from its barrel to the rotating ball.

PEN'CIL. Anything used to make marks on other materials may be called a pencil. Primitive peoples have used hard lumps of dirt or the blackened ends of burnt sticks in writing or drawing pictures. The ancient Egyptians, Romans, and Aztec Indians found that lead could be used for writing on stones and papyrus. From them we call the modern pencil a lead pencil, although its marking material is a mixture of powdered graphite and clay.

The wood used for pencils, usually cedar, is cut into thin slabs, the width of six or seven pencils, if possible. A slab is passed through a machine which cuts a small groove for each pencil. The graphite sticks are placed in the grooves, and another similar slab of wood is glued on top. When the glue has dried, the pencils are cut out of the blocks and the wooden "stick" is finished and painted.

Colored pencils consist of colored clay or chalk mixed with wax, and slate pencils are made of soft slate.

"Automatic" pencils consist of a hollow barrel containing a mechanical device by which a long piece of "lead" may be moved gradually into writing position. The barrel may be easily refilled.

PEN'DULUM. A weight suspended from a point so that it can swing back and forth is a pendulum.

Hang any weight by a string and count the number of swings it will make in a minute when pulled a few inches to one side, and how many when pulled twice as far. The count will be practically the same in both instances. Hang the weight first with a long string, then with one a fourth as long. The latter will be found to give the pendulum approximately twice as many vibrations per minute. If an iron weight is used, it will be found to vibrate more rapidly when a magnet is placed beneath the lowest point of its swing.

These three experiments demonstrate the laws governing the action of the clock pendulum. In the first place, the time of the swing (which regulates the speed of the clock) is virtually independent of the amplitude of the vibration. Secondly, the time is proportional to the square root of the length of the pendulum. In the third experiment the effect of the magnet illustrates that of the force of gravity. For a pendulum swings faster in San Francisco than in Denver and faster in Montreal than in New Orleans, because the force of gravity pulls more strongly at sea level and high latitudes.

An examination of almost any pendulum clock will show that its pendulum can be lengthened or shortened by a screw when it does not keep good time. Because metal expands when hot, a pendulum will swing faster in cold weather than in hot. Very expensive clocks have mercury in their pendulums; this element expands upward as the pendulum lengthens under the influence of heat, thus making the length of the swing uniform in all weathers. See *Clock*.

PENELOPE, *pe nel' o pe*. According to mythology, Penelope, faithful to her husband Odysseus (Ulysses), resisted the attentions of many suitors while he, the hero of the *Odyssey*, wandered for years in strange lands. First, she tried to drive the suitors away by promising to marry one of them when she finished weaving a tapestry, but she always unraveled it so that she would never finish it. Then, when they discovered this trick, she promised to marry the suitor who could bend the powerful bow that Odysseus had left behind. None of them could do it, on the day set, except an old beggar who had just arrived. The beggar turned out to be Odysseus, and, after being reunited with his wife, he slew the suitors. See *ULYSSES*.

PENGUIN, *pen'gwin*. Waddling awkwardly across the Antarctic ice in little groups as they stand erect, penguins, those odd, manlike birds with glistening white "shirt fronts," always seem to be on their way to a formal party. The penguin resem-

bles a duck and varies in length from eighteen inches to three feet. On land, the bird walks erect on its webbed feet or crawls with the aid of its wings, but in the water it is a graceful and rapid swimmer, using its wings as paddles and steering with its feet. The wings, being short, are useless as a means of flight. The birds live in colonies.

Penguins are protected from the intense cold of their native Antarctic region by a thick coat of fat. The silvery-white breast, bluish-gray back and wings, black head, and yellow throat give the penguin a striking appearance. Usually a single egg is laid in a crude nest of sticks or pebbles, and sometimes in a frozen region the egg is held between the feet and body while it is hatching.

When Amundsen went to the South Pole, although these queer creatures had not been seen before, they exhibited little alarm or fear. Showing a curious and intelligent interest, they seemed to be trying to imitate some of the movements of the men.

PENICILLIN is a drug that is effective in treating a wide range of infections, but which requires great care in administration. Physicians are working to establish a general public attitude toward penicillin which would lead to its being taken no more than absolutely necessary. There have been numerous cases of unfavorable reactions indicating strongly that it is not always possible for the human system to adjust to the drug.

Penicillin was discovered by Dr. Alexander Fleming of Great Britain in 1929. It was not widely used, however, until World War II. Then, in 1940, two other scientists made it into a brown powder and production on a large scale was possible. Fleming and these two men received the 1945 Nobel award in medicine for this scientific work.

The period following World War II has seen great effort to make progress in developing the uses of the drug. It has been combined with other antibiotics for more effective results but there is

6337

6337 5802





SUCCESSFUL COLONIZER, TREATY MAKER

During the lifetime of the founder of "Penn's Wood," his colony grew and prospered; the Indians respected the treaty Penn made with them at Shackamaxon under the Treaty Elm, declaring that the pact should continue "as long as the Sun and Moon shall endure." It was not until the French and Indian Wars that they became hostile. Left, a picture regarded as an authentic likeness of William Penn at the age of twenty-two.



the danger of this step causing the qualities of penicillin to be canceled out by those of the other drugs. It has been used to treat "strep throat" infections and rheumatic heart disease.

PENN, WILLIAM (1644-1718). The great state of Pennsylvania takes its name from and begins its history with William Penn, who renounced the life of an English gentleman of wealth to become a Quaker preacher.

Penn's father, Sir William Penn, was a wealthy admiral and was able to educate him at Essex and Oxford. But at Oxford he adopted the unpopular Quaker faith and was expelled for refusing to attend church

services or to wear the required student garb. His father sent him on a journey to France and Germany. Upon his return to England, he studied law and was sent to take care of his father's properties in Ireland. There he was put in prison for attending a Quaker meeting.

Finally he became a Quaker preacher, and for his preaching and writing was imprisoned in England at two different times. While in prison, Penn wrote *No Cross, No Crown*.

His father having died in 1670, Penn inherited his estate and also a claim against the government for \$80,000. In settlement of the claim, he was given a grant of land

in America, comprising what is now the state of Pennsylvania. The charter, granted in 1681, especially stated that the colony should have laws and regulations expressing such views and opinions as he saw fit. Because Penn was liberal and broad-minded, the colony he founded a year later was based on the most democratic principles then existing in the world; and oppressed citizens from all over the world came to the new city of Philadelphia, on the banks of the Delaware. In 1683 he made a treaty with the Indians, which was faithfully observed.

In 1684 Penn returned to England, where he remained for fifteen years. Falling under the displeasure of William III because of his friendship with Charles II and James II, he was tried for treason and for two years lost the right to govern his colony. He finally returned to Pennsylvania in 1699, but in two years went back to England, leaving his affairs in the hands of a dishonest agent. This man set up false claims against Penn, and upon his death, his family pressed the claims. Penn refused to pay them and went to prison as a debtor; but his friends brought about a settlement and had him released. His health was impaired, and in 1712 he suffered a paralytic stroke, but continued to live until 1718. See PENNSYLVANIA.

PENNELL, *pen'el*, JOSEPH (1860-1926). Outstanding among American etchers and lithographers, Joseph Pennell is noted for his simplicity, perfect technique, and pleasing composition.

Born in Philadelphia, Pennell studied at the Pennsylvania Academy of Fine Arts and the Pennsylvania School of Industrial Art. From 1884 he spent most of his time in Europe, chiefly in London. As a writer as well as an artist he achieved distinction.

Together with his wife, Elizabeth Robins Pennell, he wrote *Lithography and Lithographers* and *The Authorized Life of J. McN. Whistler*. Among his own best-known writings are *A Canterbury Pilgrimage*, *An Italian Pilgrimage*, and *Our Sentimental Journey Through France and Italy*.

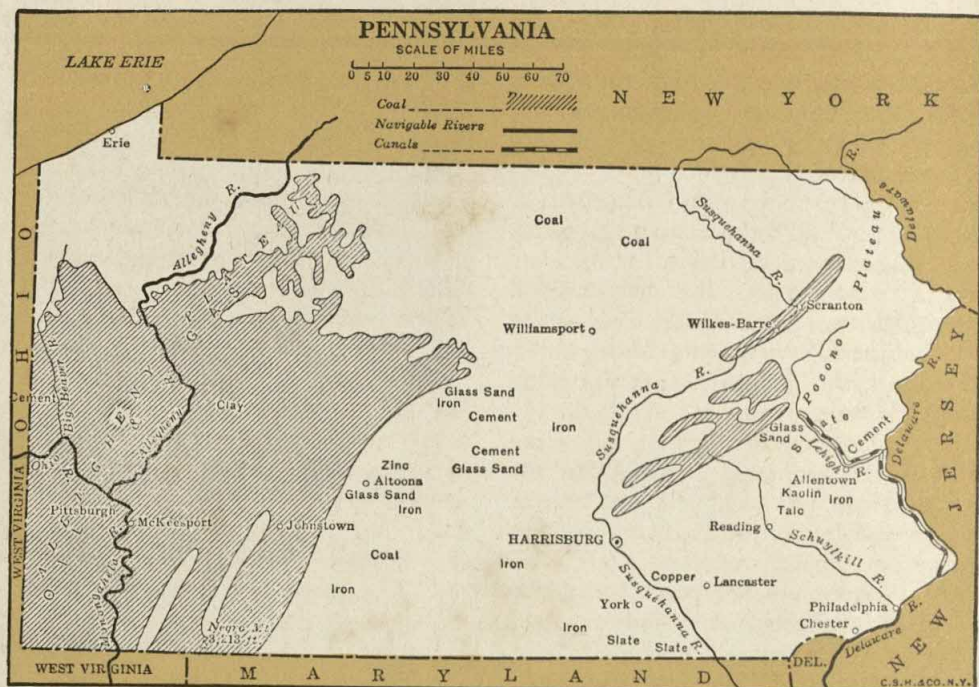


Dutch Festival, Kutztown, Pa.
BUTTER FRESH OUT OF THE CHURN
A miss in calico demonstrates her skill at the famous Pennsylvania Dutch Folk Festival that features the famous foods of this region.

PENNSYLVANIA. Lying in the center of the arc formed by the original thirteen colonies, a position which gave it the name of "the Keystone State," Pennsylvania has come to be one of the foremost industrial sections in the world. It is not for its industries alone, however, that Pennsylvania is one of the most outstanding states in the Union. It has played a major part in the history of the United States, for here was the home of Benjamin Franklin, here the Constitution and the Declaration of Independence were written, and here was the first capital of the United States.

Pennsylvania is nearly rectangular in shape and has a total area of 45,333 square miles. It is the second largest of the Middle Atlantic states and thirty-third in size in the Union. West Virginia and Ohio lie to the west, Lake Erie and New York to the north, New Jersey to the east, and West Virginia, Maryland, and Delaware to the south.

Surface Features. Pennsylvania can be divided into three geographic regions. One region is composed of parallel mountain ranges and intervening valleys that form



A STATE OF DIVERSIFIED INDUSTRY

Abundant natural resources, proximity to markets, and an early start in industrial development have enriched Pennsylvania.

the Appalachian system. It extends in a northeast direction across the middle of the state. On the eastern border are the Blue, or Kittatinny, Mountains, through which the Delaware River cuts its way, forming the Delaware Water Gap. To the north and west of the Appalachians is the Allegheny Plateau, ranging from 1,000 to 2,500 feet in elevation and covering about one half of the state. The southeastern part of the state is the Piedmont region, a rolling area sloping from a height of 500 feet at the base of the mountains down to the coastal plains. It is the best farming region in Pennsylvania, although it is crossed by numerous chains of hills.

The rivers of Pennsylvania are valuable not only for navigation but also as a source of power. The plateau area is drained by the Ohio River, by way of the Allegheny and Monongahela rivers and their tributaries. The central and northeastern parts of the state are drained by the Susquehanna and its tributaries. The Delaware River

and its tributaries drain the eastern part of the state.

Climate. The northwest and western sections have extremes of heat and cold. The mountain regions have hard winters and cool summers. In the east the climate is changeable, with long summers and cold winters. The average temperature for the state is about 54°F., and the annual rainfall averages about forty-four inches.

Natural Resources. Pennsylvania is a top-ranking state in mineral wealth. Its deposits of anthracite, or hard coal, in the eastern part are the largest in the United States. They supply most of the hard coal used in the United States. The western half of the state contains enormous deposits of bituminous coal. There are also large quantities of petroleum, natural gas, clay, and building stone. In the eastern part of the state are some of the richest cement deposits in North America. Pennsylvania's iron ore has been largely exhausted, making it necessary for the fac-

tories to import most of their iron ore. The state ranks high in the quarrying of slate, building stone, sand, gravel, and lime. Other minerals are copper, graphite, feldspar, and mineral water.

The valuable forests that once covered the state have been greatly depleted. A conservation and reforestation program, however, has been carried on by the state over a period of years, and there are still large numbers of trees in Pennsylvania.

Farming in Pennsylvania. Nearly three-fifths of the land is devoted to farming and livestock raising, which are among the important enterprises of Pennsylvania. Corn leads all other crops in value. Other important crops are hay, oats, buckwheat, winter wheat, rye, tobacco, and potatoes. Fruit growing is important, and large crops of apples, peaches, pears, and grapes are raised. A thriving dairy industry gives Pennsylvania high rank among the dairy states of the Union. The raising of cattle, hogs, and sheep is carried on in all parts of the state.

Manufactures. From colonial days to the present time, Pennsylvania has been one of the leading manufacturing states. Its abundant natural resources have had a tremendous influence on the development of manufacturing. Pittsburgh is the greatest iron and steel center in the world. Here are produced wire, nails, locomotives, machin-

ery, bridgework, railroad cars, and foundry articles. Other important industries include petroleum refining and the manufacture of textiles, knitted goods, clothing, floor coverings, chocolate, and paper. Shipbuilding, sugar refining, slaughtering and meat packing, the manufacture of boots and shoes, leather, glass, and chemicals, and printing and publishing are other large industries.

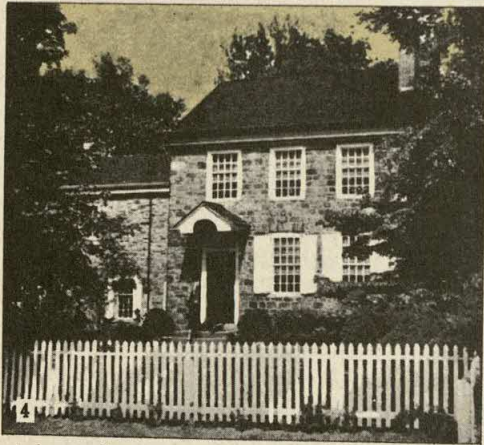
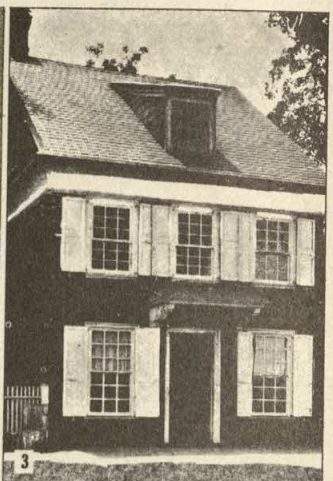
Transportation and Commerce. In addition to the raw materials, transportation facilities have aided in the development of the state. Of primary importance are the many navigable waterways that today, as in the past, carry large quantities of freight. Among the leading waterways are Lake Erie, the Allegheny and Monongahela rivers, the Delaware River, and canals that provide transportation in many parts of the state. Pennsylvania is served by fine railways, airports, airlines, and highways. Its Pennsylvania Turnpike, extending across the mountainous southern part of state, is one of the world's finest superhighways. It was the first long-distance highway in the United States to be built without any cross traffic.

The People and Their Government. The original settlers of Pennsylvania were the Swedes, Dutch, and English colonists of the coastal settlements, who were attracted by the rich soil of the state. In the

PUSH BUTTON ROOF

No rain checks are needed for events in this unusual Civic Arena in Pittsburgh. A retractable stainless steel roof swings open as shown below when the weather is good. When bad weather threatens, six movable sections roll on tracks to form a vast waterproof auditorium.





(4) Courtesy Thomas Cook & Son

QUAKER LAND HISTORIC SPOTS

Reminiscent of many events connected with the founding of a new nation are Pennsylvania's historic shrines. (1) Betsy Ross House. (2) Mollie Pitcher Monument. (3) Penn's Home. (4) Washington's Headquarters, Valley Forge.

Education. School attendance is compulsory for children between the ages of eight and fourteen. There are fourteen state-controlled normal schools, in addition to the elementary and secondary school system. There are a great number of both public and private institutions of higher learning, including the University of Pennsylvania, Haverford College, Lehigh University, Swarthmore College, Carnegie Institute of Technology, Temple University, Bryn Mawr College for Women, and Duquesne University.

History. The first permanent settlement in Pennsylvania was made by the Swedes in 1643. Twelve years later, the Dutch gained control of the Swedish settlements. Then, in 1681, after the English had forced out both the Swedes and the Dutch, Charles II granted to William Penn a charter to all the land now comprising Pennsylvania and Delaware. The colony was named Pennsylvania, meaning *Penn's Woods*.

Pennsylvania was rapidly settled by the westward-moving pioneers, who were attracted by its plentiful natural wealth. Settlement was hastened by the numerous

eighteenth century large groups of migrating Germans settled in the region and established prosperous farms. The total population is now about 11,330,000. There are large foreign-born groups, including Italians, Poles, Russians, Czechoslovakians, Germans, Irish, and English. There is also a considerable Negro element. About two thirds of the people live in urban districts. The largest cities are Philadelphia, Pittsburgh, Scranton, Erie, and Reading. Harrisburg is the capital.

The governor and other state officials are elected for four-year terms. The members of the senate, fifty in number, serve for four years; the 208 members of the lower house serve for two years. At the head of the judiciary is a supreme court, whose seven members are elected for twenty-one years.

waterways and by the Cumberland Road, which passed through the state. A long and bitter dispute between Pennsylvania and Connecticut over the fertile Wyoming Valley reached a climax in a terrible massacre in 1778. The dispute with Maryland was settled by the establishment of Mason and Dixon's Line as the boundary (see MASON AND DIXON'S LINE).

Pennsylvania may truly be called "Cradle of Liberty," for within its borders some of the most important events in the nation's history have taken place. It was at Philadelphia that both the First and Second Continental Congresses met; that the Declaration of Independence was adopted and signed; that Washington was proclaimed commander in chief; and that the Constitution of the United States was written. Several important battles took place in Pennsylvania in the Revolutionary War.

Pennsylvania was also the scene of military events during the Civil War; the Battle of Gettysburg was fought there. The nation's one-hundredth anniversary was celebrated at Philadelphia in 1876, and in 1926 its one-hundredth-fiftieth. Pennsylvania's rapid growth in industry led to many labor disturbances and gave rise to much of the state's progressive legislation.

For additional information, consult the following articles:

Harrisburg
Penn, William

Philadelphia
Pittsburgh

PEN'NY. One of the coins of the British money system is the bronze penny. In England it is equal to four farthings or one twelfth of a shilling. In terms of American and Canadian money, the penny is worth about two cents. Its symbol is *d* (*10d* is the same as *ten pence*), referring to the Roman coin *denarius*. In the United States, a one-cent coin is sometimes called a penny.

PENSION, *pen'shun*. In many businesses it has become customary to reward employes who have reached the retirement age, after long periods of service, with regular payments of money. This practice also is carried on by the Federal and state gov-

ernments for civil employes, and for widows, blind persons, dependent mothers, and persons who have served honorably in the armed forces.

These people must have reached a certain age and meet other qualifications. The money not only affords them security but aids business by giving them a means of buying needed goods and services.

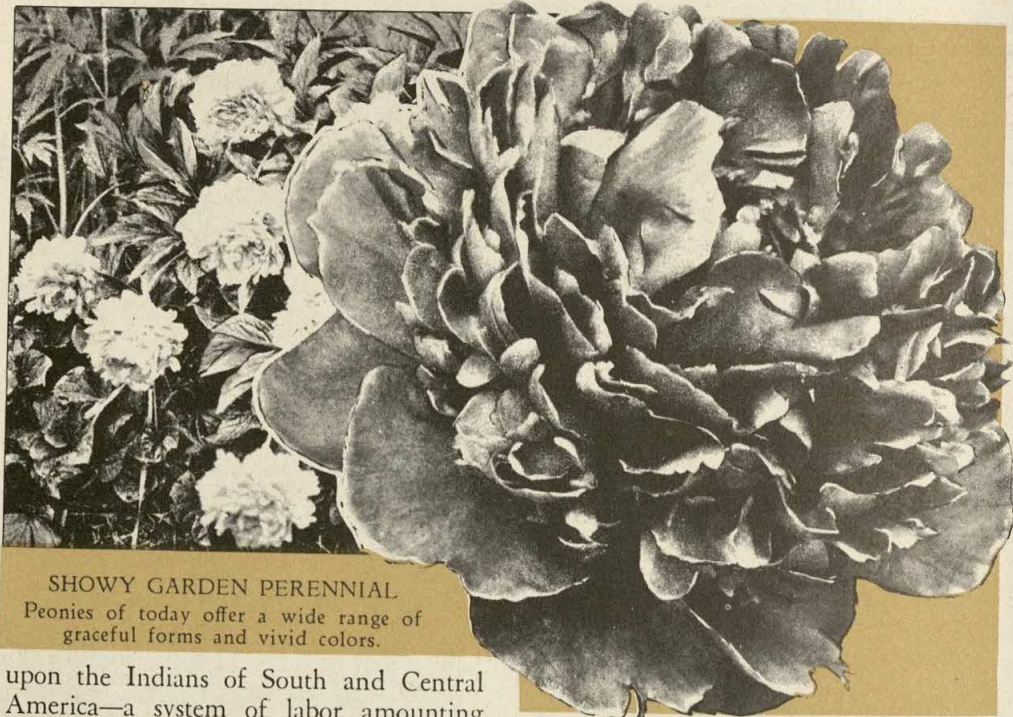
Though it has been condemned as a socialistic practice in the past, the payment of pensions by employers is now an accepted economic practice in the United States and Canada. It is usually regarded as a payment of actual wages earned while working which has been held off until time of need. That persons who receive pension money have their purchasing power kept up is something which has made up for the cost of maintaining pension plans.

Pensions are paid to qualified persons seventy years of age or more in Canada and to those who are blind and more than twenty-one. The Canadian Pension Commission administers military pensions.

The Social Security Act of the United States provides a plan for old-age pensions which has been improved upon since the act was first passed in 1935. State governments maintain pension plans such as those for teachers and other school employees. See OLD-AGE PENSIONS.

PENTECOST, *pen' te kawst*. On the fiftieth day after Passover, as marking the end of the grain harvest, the Jews held a festival called the Feast of Weeks, or Pentecost (from a Greek word meaning *fiftieth*). By the Christian Church the seventh Sunday after Easter is observed as Pentecost Sunday, in commemoration of the day on which the Holy Ghost descended upon the apostles and gave them the power to preach in strange tongues. This day is especially popular for baptisms, and from the white robes of those presented for baptism, the name Whitsunday is probably derived.

PE'ONAGE. Spain failed to hold the colonies she founded in the New World partly because of the peonage she forced



SHOWY GARDEN PERENNIAL

Peonies of today offer a wide range of graceful forms and vivid colors.

upon the Indians of South and Central America—a system of labor amounting practically to slavery. The term is derived from the Spanish word *peon*, meaning *day laborer*.

Under Spanish rule, the Indians of America were not required to join the army or to pay taxes, and the Spanish governors were charged with their protection. At the same time, they were denied all political and social privileges and were treated as inferiors. This status made it possible for landowners to impose compulsory labor through debt contracts and by other devices. Similar conditions have existed in the Southern United States among the share croppers and colored agricultural laborers.

PE'ONY. This beautiful and fragrant perennial, a member of the buttercup family, was formerly called a "piney" by our grandmothers. It is unusually hardy, and has long stems and dense, green foliage. Growing almost as large as a chrysanthemum, peonies appear in a variety of colors—white, pink, yellow, purplish, and crimson. California and Japanese varieties grow on stalks three or four feet high and are started either from cuttings or from seeds.

PEP'PER. When Alaric the Visigoth conquered Rome in the year 410, he carried away, as part of the city's ransom, a ton and a half of pepper. It was indeed an imperial ransom, for pepper was one of the most valuable of all commodities known in ancient Rome. Later, the merchants of Venice and Genoa made enormous fortunes in the pepper trade, and in search of its unknown source the Portuguese sailors found their way around Africa. The pepper which was brought to Europe by the Magellan expedition sold for several dollars a pound.

The pepper of these incidents of history was *black* pepper, made from unripe dried berries of a climbing vine native to the tropics of Asia. *White* pepper is the product of peeled, ripened berries of the same plant. *Red* pepper, or *Cayenne*, is of entirely different origin, its source being the plant called *capsicum*, which we grow in our gardens to get green peppers (see *CAP-SICUM*). So-called *Jamaica* pepper is of still other origin; it is in reality *allspice* (see *ALLSPICE*).

PEP'PERMINT. Widely grown for the oil which is distilled from its leaves, peppermint is a perennial herb having leafy stalks and flowers arranged in spiky heads. More than half of the world's supply of peppermint oil is produced in Southern Michigan and Northern Indiana. Peppermint oil has a pleasant, penetrating odor and is much used in medicines and for flavoring confections.

PEP'SIN. One of the important fermenting agents in the process of digestion, found in the digestive juices of the stomach, is pepsin, which breaks down protein foods into simple peptones that can be absorbed by the blood stream. It acts only in acid, which is supplied by the hydrochloric acid of the stomach. Pepsin is used in medicines to aid digestion, and is obtained from the stomachs of calves and pigs.

PEPYS, *peeps, peps, or pep'is*, SAMUEL (1633-1703). England in the seventeenth century is vividly portrayed in the diary of Samuel Pepys, the outstanding work of its kind in English literature. Voluminous, it covers the years from 1660 to 1669 in a complete and interesting fashion, giving a detailed account of the royal court of the time. In addition to the valuable documentary material, many entries are highly amusing and entertaining.

PE'QUOT. These warlike Indians inhabited part of New England at the time the white men arrived. Almost all of them were killed in a war against the settlers in 1637.

PERCENT'AGE. In expressing the relation of one number to another without the cumbersome use of fractions, percentage is of inestimable value. It is based on the decimal system, in which all quantities are arbitrarily divided into 100 equal parts. The word itself comes from two Latin words: *per*, meaning *by*, and *centum*, meaning *hundred*. The system is not a new development, for La Salle, in the early days of American history, referred to the practice of taking as toll "six parts out of every 100 parts" of grain which were carried to the mill.

In arithmetical computations of percentage, there are three terms to be understood: the *base*, the *rate*, and the *percentage*. The base is always the number which represents the whole quantity, or 100 per cent; the rate is the fractional part of the quantity which it is desired to find, expressed decimally in hundredths; and the percentage is the fractional part expressed in terms of units of the whole quantity. In the statement $6\frac{1}{4}\%$ of \$48 = \$3, or $.06\frac{1}{4} \times \$48 = \3 , \$48 is the base; $6\frac{1}{4}\%$ ($.06\frac{1}{4}$), the rate; and \$3, the percentage.

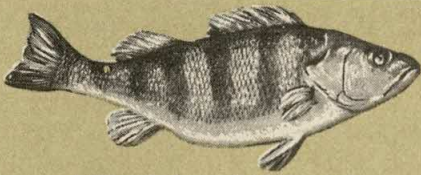
It is usually easier to make computations with percentage than with fractions, and it is often the only means of deriving a strictly accurate answer. For example, if you were required to find $\frac{3}{8}$ of $30\frac{1}{8}$, the answer could be obtained only by a long and tedious fractional computation. But under the decimal system, these numbers would become .625 and 30.125 and the product of the operation would be 18.828-125, as compared to the fractional answer $18\frac{5}{8}$, which means little to the average person.

The following paragraphs show how to work problems in percentage, when two out of three numbers are given, and the third is to be found:

(a) To find the *percentage*, the base and rate being given, multiply the base by the rate ($5.50 \times .20 = 1.1000$ or simply 1.1). The product in such a case must always be pointed off from right to left and have as many decimal places as the sum of the decimal places in both multiplicand and multiplier.

(b) To find the *rate*, the base and percentage being given, divide the percentage by the base ($1.1000 \div 5.50 = .20$). In this case, the quotient will be pointed off according to the excess of decimal places in the dividend over those in the divisor. Here there are two more places in the former.

(c) To find the *base*, the rate and percentage being given, divide the percentage by the rate ($1.1000 \div .20 = 5.50$). Pointing off of decimal places will follow the same rule as in (b) above.



FRYING-PAN FAVORITE

The yellow perch is easy to catch, easy to eat.

PERCH. The perch family of freshwater fish includes numerous species in both Europe and America. The best-known American species are: the *yellow* perch, found from Saskatchewan and the headwaters of the Missouri to the Maritime Provinces and the Carolinas; the *pirate* perch, occurring in sluggish streams from New Jersey to Minnesota and Louisiana; the *trout* perch, or *sand roller*, known from Alberta and the Hudson Bay region to Kansas and the Delaware River; and the *darters*. The darters are five inches or less in length, the other perches somewhat longer.

The *pike* perches, relatives of the true perches, are larger fishes, weighing from ten to twenty pounds.

PERFUMES. The enhancement of personal charm by the use of delicate and pleasant perfumes is a custom that prevailed in ancient times and is today the basis of an important industry. Commercial perfumes are prepared by dissolving an essential oil in alcohol, for liquid preparations, or by mixing it with a fatty base, for cosmetics. These essential oils are obtained from animal, vegetable, or artificial sources.

The principal scents derived from animals are musk, civet, ambergris, and castor. These odors are secured in the form of essential oils from the original substance by soaking it in alcohol to form tinctures. Small quantities of these tinctures are then used as a base for the perfume.

Most of the perfumes which are commonly used are obtained from vegetable sources. The most delicate and fragrant of all odors are taken from the petals of flowers, although other parts of various plants are also used. Two common processes by which such scents are prepared are

known as *maceration* and *enfleurage*. The first consists of putting the flowers in oil or fat heated at about 65°C., where the essential oil is absorbed by the fat. In the second process, the petals are spread on lard-covered plates of glass, and the lard absorbs the essential oils. After it has become completely saturated, the lard is scraped off, melted, and placed in alcohol. The lard is dissolved in the alcohol, releasing the essential oil of the flowers, which rises to the top, is skimmed off, and bottled.

In some cases, the oil is obtained directly by expression, that is by squeezing it out of the plant's fibers. The most expensive of all scents, attar of roses, is made by a lengthy process of distillation.

Artificial perfumes are built up from various organic compounds by chemical means, and the manufacture of artificial scents has developed into an important industry, owing to the popular demand for inexpensive odors. Paris and London are the chief perfume-manufacturing centers of the world, but several of the Mediterranean towns of Southern France are also noted for their products.



GOLDEN AGE RULER

Pericles, liberal leader of glorified Greece.

PERICLES, per'i kleez (about 495-429 B. c.). Athens attained her greatest glory under Pericles, who directed the affairs of

the most cultured city in Greece for twenty years. While he ruled, Ictinus built the Parthenon; Phidias carved his statue of Athena; Socrates walked the streets of the city asking his immortal questions and expounding the philosophy that was to live through the ages; Sophocles and Euripides wrote their tragic dramas; trade flourished, and Athens truly reached the heights of her leadership in every respect.

These achievements were due in large part to the wise and democratic policies of Pericles. He was an aristocrat, a member of the group that delegated all power in the city to its own high-born members. But in 449 B. C., when Cimon, the leader of the aristocracy, died, Pericles came to power and immediately set forth his liberal doctrines. He permitted all citizens, regardless of their birth or station, to be eligible for government offices; he placed the power of making laws in the hands of the Senate, a popularly elected body; he began the policy of compensating public officials, and permitted all who could pay the price to attend the theater.

Pericles also sought to make Athens powerful in military affairs, and to place the city at the leadership of a confederacy of Greek states. It seemed as if this dream would be fulfilled when Naupactus, Samos, Aegina, and Euboea came under Athens' power. But Sparta and the other Peloponnesian states became jealous, and war broke out.

Pericles might have achieved his aim, had it not been for a terrible plague that afflicted Athens in 430 B. C., and of which he died in 429 B. C. Athens was finally defeated, and her great Golden Age was at an end. See **ATHENS; GREECE; PARTHENON.**

PERMANENT COURT OF INTERNATIONAL JUSTICE. Better known as the *World Court*, this tribunal was established by the nations at The Hague for the peaceable adjustment of international disputes. Any question may be referred to the Court by agreement of the interested nations. The establishment of this Court was provided for in the Covenant of the League of Nations.

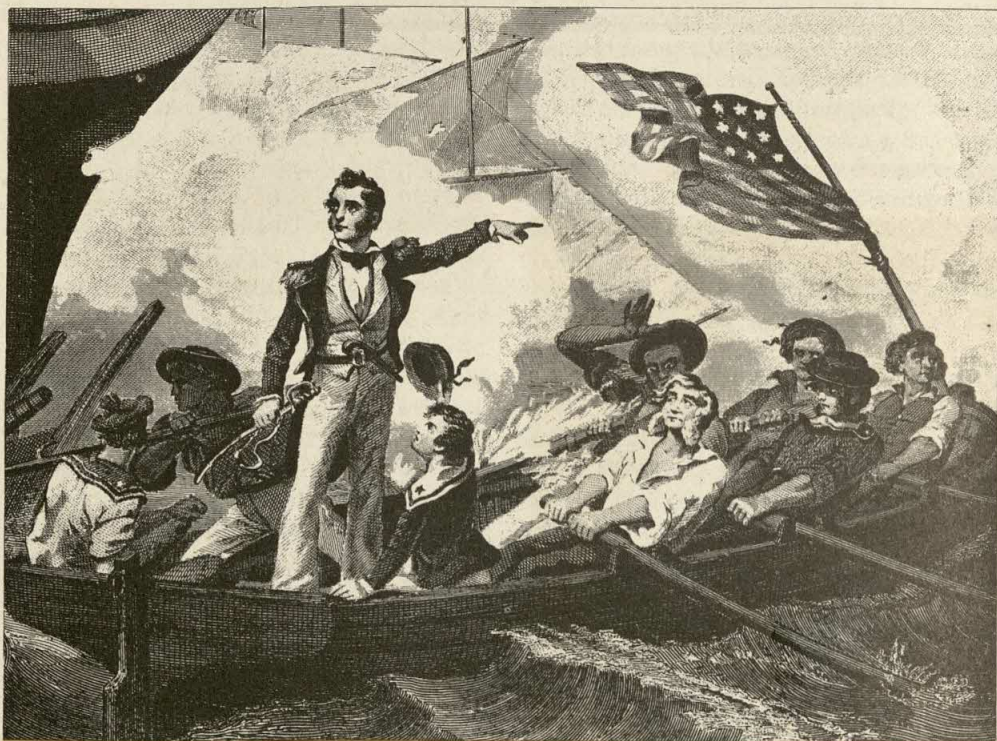
There were fifteen judges elected by the Council and Assembly of the League for nine-year terms; the judges elected a president and vice-president, who served for three years. There was at least one session of the Court yearly. When the League of Nations went out of existence in 1946, the functions of the World Court passed to the International Court of Justice, the judicial branch of the United Nations. See **NATIONS, LEAGUE OF; UNITED NATIONS, THE.**

PERPETUAL MOTION. A perpetual-motion machine, the dream of thousands of inventors, is not only a machine that will run forever under its own power, but a machine that will do work without using an outside source of energy. According to the laws of physics, which state that energy cannot be created, the perpetual-motion machine is a mechanical impossibility. The history of the attempts to create such a machine is a fascinating one, but so far no one has satisfactorily demonstrated such a device. See **ENERGY.**

PERRY, MATTHEW CALBRAITH (1794-1858). A distinguished American naval officer and brother to Oliver H. Perry, Matthew Perry performed his most valuable service when he sailed for Japan in 1852 and succeeded in negotiating a treaty providing for commercial relations with the United States.

Perry was born at South Kingston, R. I. He entered the navy at the age of fifteen and served in the War of 1812, becoming a lieutenant in 1813. He led several minor expeditions against the West Indian pirates. Perry was made a commander in 1826 and a commodore in 1841. He commanded the fleet assigned to suppress the African slave trade, and also commanded the fleet during the Mexican War of 1846.

PERRY, OLIVER HAZARD (1785-1819). A brave and daring naval officer who saw service in the War of 1812, Oliver Hazard Perry was born at South Kingston, R. I. He made a place for himself in the pages of history with his memorable defeat of a British force in a battle on Lake Erie in 1813. Facing a British force of six vessels,



WINNING CONTROL OF LAKE ERIE

Perry's complete victory at the Battle of Lake Erie enabled General Harrison to invade Canada, win the Battle of the Thames.

Perry, with nine ships, engaged the British in a fierce three-hour battle. Although his own flagship, the *Lawrence*, was disabled and he lost four fifths of his men, Perry announced at the close of the encounter, "We have met the enemy and they are ours—two ships, two brigs, one schooner, and one sloop." For his achievement Perry was given a gold medal and made a captain.

In 1819 he went to the West Indies in command of a squadron. There he contracted yellow fever and died at Port of Spain, Trinidad. Many years later his body was taken to Newport, R. I., where a statue was erected to his memory.

PERSEP'OLIS. When Darius and the Persians ruled the destiny of the Mediterranean, Persepolis was the capital of the empire. Situated in a fertile valley near the modern city of Shiraz, in Iran, it was a center of trade. Alexander the Great

destroyed it in 331 B. C. Later, when a new city was built, it, too, was demolished.

PERSEUS, *pur' se us*. Slayer of the dread Gorgon Medusa, whose glance turned people to stone, Perseus is a hero of Greek mythology. Sent on the mission by King Polydectes of Seriphus, he was given the winged sandals of Hermes, the magic shield of Athena, and the miraculous helmet of Pluto, which made him invisible.

When he found Medusa, he cut off her head but was careful to look at her only as a reflection in Athena's shield. Then he flew home with the head. According to legend, the blood that dripped from the head as he flew over the sea was used by Neptune to create Perseus' steed, Pegasus. On his way, Perseus had several adventures. He rescued Andromeda from a sea serpent and showed Atlas the head, turning him into a mountain. When he came to Seriphus, he turned Polydectes to stone, also,

for persecuting his mother. His mission fulfilled, Perseus, Andromeda, whom he married, and his mother went to Argos. There Perseus killed his grandfather accidentally; but even so, Perseus was honored by the gods when he died. He was placed in the sky as a constellation.



AMERICA'S CHIEF IN WORLD WAR I

PERSHING, *pur'shing*, JOHN JOSEPH (1860-1948). America's fate in the First World War was largely in the hands of General John Joseph Pershing, a skilled and experienced officer whose ability was universally respected. To the 2,000,000 "doughboys" whom he led to France, he was the beloved "Black Jack." To the Allied leaders, he was an able and courageous soldier, willing to co-operate with France and England and contributing much to the final victory on the Western Front.

Born in Linn County, Mo., he attended the Northeast Missouri State Teachers' College at Kirksville. He attended West Point, graduating in 1886. He served in the skirmishes with the Apache and Sioux Indians, and during the Spanish-American War saw action at Santiago in Cuba. Transferred to the Philippines, he organ-

ized the Bureau of Insular Affairs and later became military governor of the islands. He left the Philippines in 1905 to become military attaché at Tokyo, where he was promoted to the rank of brigadier general. Later, he became governor of Moro Province in the Philippines.

In 1913 Pershing took command of the Eighth Brigade at San Francisco, where his wife and three daughters died in a tragic fire. In 1916 he led an expedition into Mexico against Francisco Villa, and the next year became commander on the Mexican border. In 1917 he was given command of the American Expeditionary Force to France.

Made a general, Pershing carried out the great task before him with superb efficiency. After the war, he served as Chief of Staff of the United States Army from 1921 to 1924, when he retired. His book, *My Experiences in the World War*, won a Pulitzer prize in 1932. See WORLD WAR I.

PERSIA. See IRAN.

PERSIAN GULF. An arm of the Arabian Sea, stretching some 500 miles north-east from the Strait of Ormuz, the Persian Gulf separates Iran from the Arabian Peninsula. Its average width is about 180 miles. The Shatt-al-Arab River, formed by the joining of the historic Tigris and Euphrates rivers, flows into it. Its most important islands are Qishm and the Bahreins. Because the gulf is a valuable gateway between the East and the West, its control during World Wars I and II was strategically important to both sides. During the latter conflict, it served as a supply lane between Russia and her allies.

The gulf is one of the world's chief sources of pearls, and under its parched, sandy shores and islands lies one of the greatest pools of oil on earth, producing a fabulous amount of oil every year.

PERSIMMON, or DATE PLUM. An orange-colored fruit with a sharp taste before ripening, the persimmon is of two types—American and Japanese. The American persimmon tree, which grows principally in the South, attains a height

297

D/133

of sixty feet and bears fruit about the size of a plum, which contains several oval seeds. Most persimmons are edible only after a frost. The Japanese variety, which is the persimmon of commerce, produces a

larger, reddish, and better fruit. Japanese persimmons are frequently dried for sale. Many varieties are seedless. Japanese trees are grown in California, Florida, and the Gulf states.

In the Land of the Incas



PERU. On the western coast of South America, the Republic of Peru extends along the Pacific for about 1,400 miles. It is bounded on the south by Chile, on the east by Bolivia and Brazil, and on the north by Ecuador and Colombia. Its area is about 482,000 square miles. An old boundary dispute with Ecuador was settled to the satisfaction of both countries in 1942.

A Rugged Land. Peru has three distinct geographical areas. From the Pacific eastward to the foot of the Andes is a dry area which requires irrigation to cultivate any crops. To the east of the desert is the mountainous region, occupying fully half of Peru; between the mountain ranges are fertile plateaus. On the east side of the mountains is the Montaña, a densely wooded, tropical region, which rolls off to meet the low plains of Brazil.

The rivers of the coastal plains are short and unimportant; those originating in the mountains flow off to the north joining the tributaries of the Amazon. Of the many lakes in Peru, Lake Titicaca is the largest;



Courtesy Thomas Cook & Son

PERU BECOMES NEW CASTILE

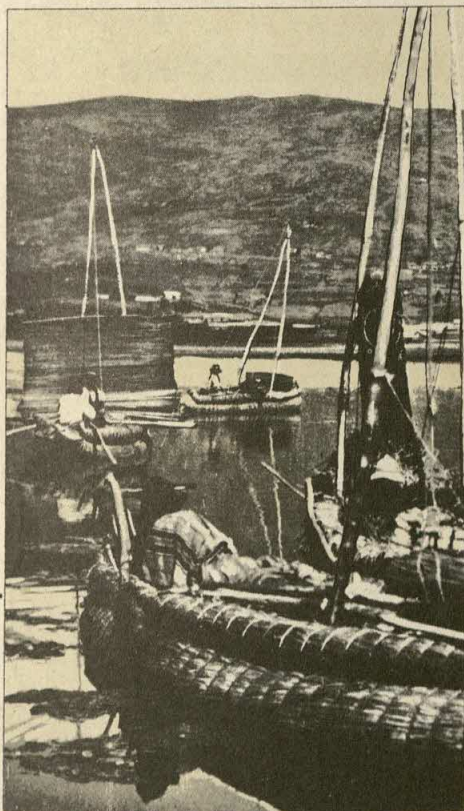
Pizarro and his adventurers (above) replaced Inca culture with Spanish. Right, in old Cuzco.



it is the highest lake in the world navigable by steamers.

Climate. The climate along the coast is dry and unhealthful, though not excessively hot, owing to the sea breezes and currents. Toward the mountains, the temperature drops noticeably and rainfall varies from light to moderate. On the eastern slopes, the climate is tropical and the rainfall is heavy.

Natural Resources. Most of Peru's natural wealth comes from her minerals, the most important of which are copper, silver,



SAILING THE INCAS' SACRED LAKE
The characteristic canoe-shaped fiber rafts cluster at the shore of Lake Titicaca.

lead, petroleum, gold, coal, and tungsten. Peru furnishes most of the world's supply of vanadium.

Industries and Transportation. Agriculture is the chief occupation. In the lowlands and valleys, rice, cotton, and sugar



Ewing Galloway

IN THE CITY OF THE KINGS

The Columbus statue by Revelli stands at the head of the street, Paseo Colon, in Lima, capital of Peru.

cane are important crops; in the upland areas grains and fruits are raised. The products of the tropical eastern section consist chiefly of rubber, cinchona, dyestuffs, medical herbs, and cacao products. The alpaca, llama, and sheep furnish valuable textile materials.

There are now some 600 factories in Peru, and manufacturing is becoming increasingly important.

There are only about 2,800 miles of railroads in Peru. Of highways there are over 18,000 miles. In addition, there are between 3,000 and 4,000 miles of navigable rivers, mostly east of the Andes. Foreign commerce is carried on chiefly with the United States, Great Britain, and Germany. Callao, near Lima (the capital), is the leading port.

People. Peru's estimated population is 10,213,000. About half of the people are Indians, one fourth are *mestizos* (mixed), and the remainder are whites, most of whom are Spanish. Roman Catholicism is the most important religion and is protected by the government.



THE LOFTY REPUBLIC OF PERU

The map at the left shows the location of Peru and its neighbors in South America. Above is a Peruvian Indian family with its llama.

Government. The Republic of Peru's present constitution was adopted in 1933. Its President, who may not succeed himself, and two Vice-Presidents are popularly elected for six-year terms. An Economic Advisory Council and a Cabinet, headed by a Prime Minister, assist the President. The directly elected legislature consists of a Senate and a Chamber of Deputies.

Education for all children between the ages of seven and fourteen is compulsory and free. Yet the country still had schools for less than half of this group when an ambitious building program was announced in 1946. As a result, over half of the people are illiterate. The University of San Marcos, founded in 1551, opened in 1576, and the oldest of the Americas' universities, is at Lima.

History. When the Spaniards arrived in the 1530's, they found the powerful Incas ruling not only Peru, but also more than half of South America. Quickly conquered by a few explorers, Peru then became the center of Spanish power in the Americas.

Peru declared its independence in 1821, but did not become free until it had defeated Spain in a bitter war lasting until 1824. Both José de San Martín and Simón

Bolívar helped Peru win freedom.

The country's first democratic government, pledged to carry out various social reforms, was elected in 1945, but was ousted in 1948. The Provisional President chosen by the military junta that then assumed power ran unopposed in a 1950 election and was elected President.

Peru sided with the Allies in World Wars I and II and joined both the League of Nations and the United Nations (as a charter member). See BOLÍVAR, SIMÓN; INCA; PIZARRO, FRANCISCO.

PESETA, *pa sa' tah*. The name of this coin, which is the standard unit of Spanish money, means *little peso*. Normally worth about 19 cents in American money, it has been issued in silver in values of one, two, and five pesetas; also in gold and in brass. The peseta contains 100 *centimos*. See PESO.

PESO, *pa'so*. The standard unit of money in most South and Central American countries and in the Philippines, the peso originated in Spain. Coined in gold, it was called the *peso de oro*; in silver, the *peso de plata*. The silver peso, still called a dollar in most places, varies in value from country to country.

PETER, or SIMON PETER. One of the twelve apostles, Peter was a fisherman on the Sea of Galilee with his brother Andrew. He was first attracted by the preaching of John the Baptist, and later dedicated his life to the service of Christ. Peter was one of Christ's most ardent followers, and after the crucifixion of Christ was recognized as one of the leaders in the Christian movement. He has been credited with writing the two *Epistles of Peter*. The Roman Catholic Church honors Saint Peter as its founder and first Pope. According to tradition, he was crucified, head downward, in Rome.

PETER I, ALEXEYEVITCH (1672-1725). Strong, brave, and ruthless, Peter the Great, czar of Russia, was an outstanding ruler who raised his vast country to the rank of a major European power. Peter had little education and grew up unfettered by the iron-clad rules of the nobility. When his

brother Feodor died, in 1682, Peter became czar; but his half sister Sophia ruled as regent until 1689, when he placed her in a convent and proceeded to rule the country as he saw fit.

Peter never permitted his rank to prevent his mingling with the common people. When he went to Prussia, Holland, and England, in 1697, he worked as a common laborer to learn the art of shipbuilding; and when he returned to Russia, he was able to create a navy under his personal direction. Opposed by the nobles, he nevertheless organized schools, created industries, especially for arms, built roads and canals, raised the political status of women, and instituted sweeping reforms in government offices. Peter, to gain his ends, was even forced to condemn his son, Alexis, to death and to imprison his wife, for their opposition to these reforms.

Seeking a port that would be open most



THE BEGINNINGS OF A RUSSIAN NAVY

Peter the Great liked to get knowledge from first-hand experience: here he is learning shipbuilding in Holland.



POMP AND CIRCUMSTANCE FOR A POET

At the height of his literary prestige, Francesco Petrarch visited many courts. Here he and Laura meet Charles IV, at Avignon.

of the year, he warred against Sweden and seized the Baltic provinces. He built Saint Petersburg (now Leningrad) and its harbor, Kronstadt. He then turned his attention to the south and warred against the Turks, thus setting the future policy of Russia in respect to gaining a foothold in Constantinople. Peter was succeeded by his wife, Catharine, in 1725. See RUSSIA.

PETERSBURG, SIEGE OF. Marked by terrible slaughter on both sides, but an important factor in ending the Civil War, the Siege of Petersburg, Va., lasted from June, 1864, to April, 1865. The Federal army under Grant took up a position before the fort for the purpose of capturing this point and forcing the Confederate army to leave near-by Richmond, the Southern capital. The siege opened with an unsuccessful

three-day attack under General Butler. In the following month, General Burnside supervised the construction of a mine under the fort to open the position to attack. Because of poor leadership, the Union army was trapped and more than 4,000 men killed. Finally, in April, 1865, after a week of heavy bombardment, the position fell and the Confederate officials and army quitted Richmond. Six days later, on April 9, Grant and Lee met at historic Appomattox to arrange the surrender which ended the war. See CIVIL WAR IN AMERICA.

PETER THE HERMIT (about 1050-1115). Raising an army of 30,000 through the fiery eloquence of his preaching, Peter the Hermit, a monk of Amiens, France, aided in the organization of the First Crusade to free Jerusalem from Mohammedan

rule. Peter led his army across Southern Europe to Constantinople, joined forces with Walter the Penniless, and crossed to Asia Minor. In a battle with the Turks they were defeated, and he returned to Constantinople. Later he joined the army of Godfrey de Bouillon and remained until the capture of Jerusalem had been accomplished. After his return to France, he founded a church and remained at its head until his death. See CRUSADES.

PETITION, *pe tish'un*, OF RIGHT.

Historic in the struggle of the English Parliament to curb the powers of the king is the Petition of Right, a document directed against the tyranny of Charles I. The petition was drawn up in the House of Commons when Charles convened Parliament in 1628 for the purpose of gaining its approval for additional funds. Instead, a list of grievances was made out, rehearsing all the violations of law brought about by Charles, and condemning him for usurping rights which were not his. Charles resisted this petition, but he was finally forced to assent to it, in 1629. For details, see CHARLES I.

PETRARCH, *pe'trahrrk*, FRANCESCO (1304-1374). Surpassed only by Dante in Italian poetry, Francesco Petrarch composed some of the world's finest lyric poems and epics. He was born at Arezzo, Italy. In 1327 he went to Avignon, France, where he met the beauteous Laura who inspired his great love poems.

Petrarch remained in Avignon for three years, after which he traveled extensively in Italy, France, and Germany. He then settled down in his estate at Vacluse, near Avignon. Here he remained until 1360, when he went to Arquà, near Padua, and continued his literary pursuits. During this period of residence at Avignon, Petrarch traveled frequently in Italy, where great honors were heaped upon him. Writing in both Italian and Latin, Petrarch scorned his Italian works and took much pride in his fine, polished Latin verse. Today, however, the world knows him only for his Italian poems.

His Latin poems include *Africa*, an epic which won for him the laureate crown of Rome, and *Triumphs*, written after he had learned of Laura's death.



WALKING ON THE WAVES

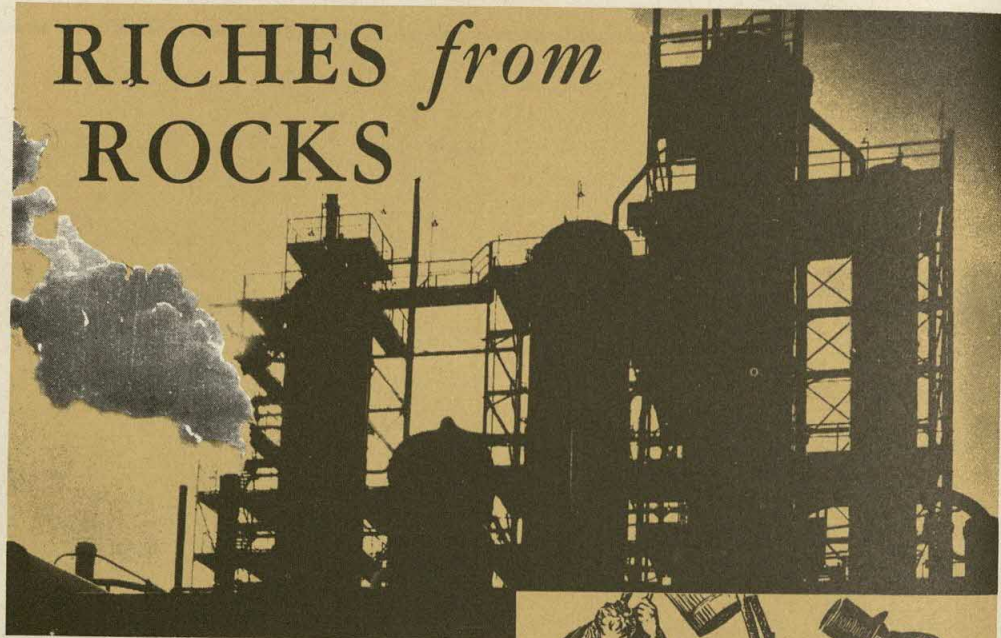
For sailors the petrel is a weather prophet.

PET'REL. Gliding along close to the surface of the water with a quick, graceful movement, the petrel, an odd sea bird, seems almost to walk on the water. Usually about the size of a duck, this soberly colored bird, with long legs and webbed feet, is a strong flier. It rests by settling in the water duck-fashion and tucking its head under its wing. The petrel breeds in colonies on rocky, forbidding coasts and lays only one egg, which is deposited in a rocky crevice or in a burrow in the ground.

There are many species of the petrel in both northern and southern climates. The best known are *Wilson's* petrels, in the Antarctic; *Leach's* petrels, on the northwestern coast of North America; and *Mother Carey's chickens*, or the *stormy* petrels, found far out over the Atlantic and believed by sailors to be a sign of bad weather. The stormy petrel is only about five inches long.

PET'ROGRAD. See LENINGRAD.

RICHES *from* ROCKS



PETRO'LEUM. Heir to the throne long held by coal, petroleum is a substance responsible for man's greatest victories over his environment. Petroleum furnishes gasoline to run automobiles and airplanes; lubricating oil to keep machines running smoothly and swiftly; kerosene to light lamps; fuel oil to heat homes and run the engines of streamline trains, battleships, and ocean liners; naphtha for illumination, fuel, paints, and varnishes; benzine for solvents and cleaning fluid. Petroleum jelly, paraffin, tar, mineral oil, pitch, coke, crayon, asphalt, plastics, synthetic rubber, and even candy are by-products.

The petroleum industry exerts a tremendous influence on world affairs. Petroleum is not found everywhere; and to possess it, the great powers of the world are ever searching for lands where this "black gold" may be obtained. Military campaigns, treaties, and international complications involving millions of people have been based on the demand for oil. In the United States petroleum has been responsible for the rise of some of the country's wealthiest men and corporations, and its production and distribution give em-



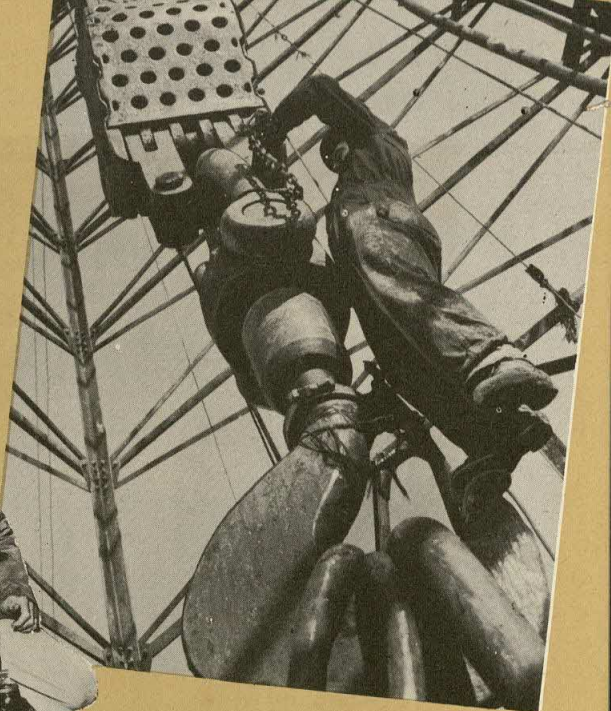
Courtesy Standard Oil Co.

DAWN OF GIANT INDUSTRIES

Drilling the Drake well on Oil Creek lit the lamps of the world; set the stage for the tremendous expansion of the automobile age.

ployment to thousands. Every year the world produces billions of barrels, over two thirds of which come from the Americas. In the United States, by far the greatest producer, Texas is the top supplier, but oil is obtained in more than three fourths of the states. This abundance is partly responsible for the relative cheapness of gasoline in that country and for the great number of automobiles there.

Other leading oil sources include Venezuela, Soviet Russia, Iran, Saudi Arabia, Kuwait, Mexico, Indonesia, Rumania,



AN INFANT INDUSTRY GROWS UP

The oil industry got its start with Drake's first well (top left). Today, scientists equipped with specialized instruments (left) locate deposits of petroleum for the drillers (above).

*Standard Oil Co. (N.J.);
Sinclair Refining Co.*

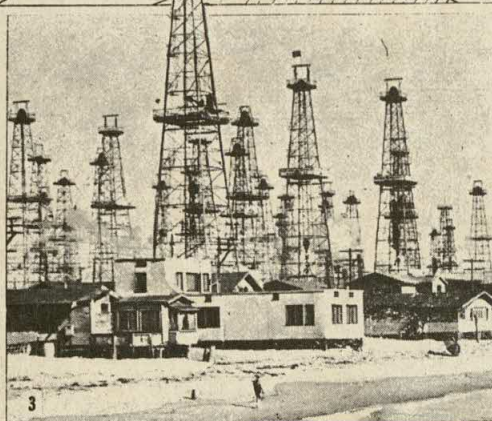
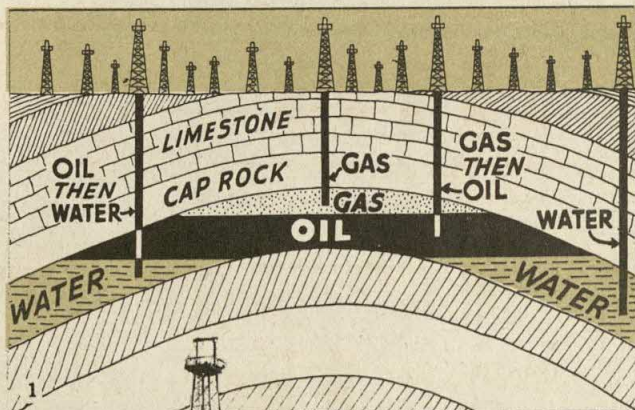
Iraq, and Colombia. Within a remarkably short time after Alberta's oil fields were opened in 1947, Canada also became a top producer of petroleum.

In appearance, petroleum is a dark-colored, strong-smelling liquid, ranging in color and weight according to the character of the region where it is found. It is a mixture of hydrocarbons, and originated probably thousands of years ago in animal and vegetable matter. It had been known for years, but it was not until 1859 that it became commercially useful. In that year, Edwin L. Drake drilled the first oil well in Pennsylvania. The production of petroleum made possible the internal-combustion engine; and the development of the airplane, automobile, and petroleum industries went hand in hand.

Petroleum Production. In the impor-

tant oil fields, one may see a forest of derricks pumping the liquid from a depth of 300 to 5,500 feet. Some wells, however, have been drilled much deeper, the deepest being well over 16,500 feet. Occasionally an oil well need not be pumped, for when the drills reach the bed far below the surface, the oil will spout up as a gusher. This action occurs whenever oil is under great pressure. Brought to the surface, oil is stored in great tanks, then is carried to refineries for processing by pipe lines, railway tank cars, tank trucks, or boats called tankers.

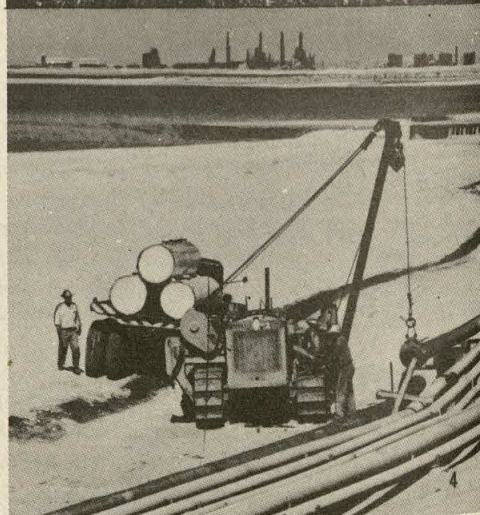
Because petroleum is made up of many substances which boil at different temperatures, it is possible to heat it, and, as the heat increases, to draw the vapor of the different substances from the top of a still.



American Petroleum Institute; Standard Oil Co. (N.J.)

"OIL IS WHERE YOU FIND IT!"

(1) A cross section of an oil field, showing the geological formation. (2) An old-fashioned, wasteful "gusher." (3) A cluster of derricks. (4) An oil pipe line in Saudi Arabia.

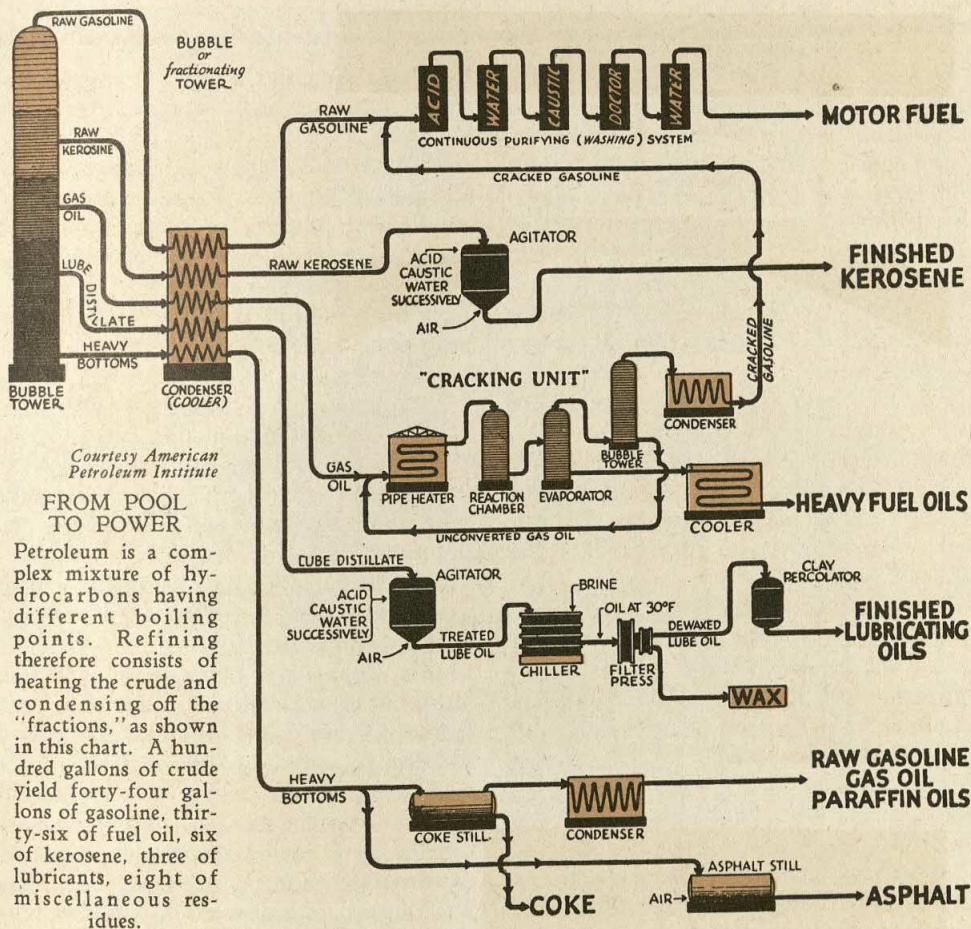


The vapor escapes through a pipe and is cooled by cold water. It is carried to other tanks as naphtha, benzine, gasoline, or kerosene. The mass remaining in the still is made into lubricating oil, petroleum jelly, and other products.

Cracking is a high-pressure process for obtaining gasoline. The petroleum is submitted to pressure and heat, forcing the molecules of the heavy hydrocarbon substances to "crack" into lighter compounds, thus forming gasoline.

For additional information, consult the following titles:

- | | |
|------------|-------------|
| Automobile | Naphtha |
| Gasoline | Pipe Lines |
| Kerosene | Well Boring |



Courtesy American Petroleum Institute

FROM POOL TO POWER

Petroleum is a complex mixture of hydrocarbons having different boiling points. Refining therefore consists of heating the crude and condensing off the "fractions," as shown in this chart. A hundred gallons of crude yield forty-four gallons of gasoline, thirty-six of fuel oil, six of kerosene, three of lubricants, eight of miscellaneous residues.

PETU'NIA. Of all the garden annuals, the petunia produces flowers most freely. Because of their large size, their ruffled petals, and their wonderful range of colors, petunias are magnificent flowers for our gardens. Each plant, if given the space, will spread over a square yard of ground surface; furthermore, petunias may be trained attractively on small trellises or stakes. Although not a good cut flower, its great value for window boxes and beds makes the petunia one of the best annuals. Petunias belong to the same family as the tobacco and potato plants.

PEW'TER. Collectors of antiques prize vessels made from pewter, an alloy of tin with lead, copper, antimony, or bismuth (see **ALLOY**). There are three common

varieties known as *ley*, or *common*, pewter, *plate* pewter, and *trifle* pewter. The finest pewter consists of tin hardened by being alloyed with a little copper. Pewter is a soft alloy, resembling tin except that it is darker and duller.

At one time, almost every household utensil was made of pewter—pots, cream jugs, tankards, flat tableware, salt and pepper shakers, pitchers, goblets, and so on. Pewter inkstands, snuffboxes, watchcases, lamps, candlesticks, and a host of other articles were seen in homes a few generations ago. There has been a revival of the use of this metal, and in many modern households, pewter pitchers, drinking glasses, and other utensils are in general use.

PHAËTHON, *fa' e thon*. One of the legends of classical Greece, the story of Phaëthon shows how the ancients explained the frozen wastelands of the North and the dark skins of the African tribes. The son of Apollo and Clymene, this boastful youth entreated his father, the sun god, to permit him to drive the chariot of the sun across the sky. To this request, Apollo reluctantly agreed, and Phaëthon set out. The horses soon knew that their driver was inexperienced. They plunged madly off their course, coming so close to the earth that the people of Africa were burned black, and again rising so high that everything became a frozen waste. Zeus ended this mad race across the sky by striking Phaëthon from the chariot with a thunderbolt, hurling him into the river Po. See MYTHOLOGY.

PHANEROGAMOUS, *fan ur og'a mus*, **PLANTS, or PHANEROGAMS**, *fan'ur o gamz*. Plants which bear flowers are phanerogamous plants. They are distinguished from the cryptogams (which bear no flowers) in that they produce seeds, each of which contains an embryo. The cryptogams, on the other hand, grow spores, simple cells without an embryo. See BOTANY.

PHARAOH, *fa'ro*. The kings of ancient Egypt were known as Pharaohs. They ruled in dynasties, those of the so-called "shepherd-king" dynasty being the cruel Pharaohs who placed the Israelites in bondage. Rameses II probably was the Pharaoh at the time of Moses. See BIBLE STORIES.

PHARISEES, *fair'i seez*. At the time of Christ, the Pharisees were an old religious sect among the Jews, who had an important part in the stirring events of that period. They are mentioned a number of times in the New Testament. In addition to standing for a strong, centralized government among the Jews, directly opposed to the position of the Sadducees, they advocated a strict, highly moral code of living, difficult for the majority of people to uphold.

The Pharisees were extremely pious and patriotic and undoubtedly were the most learned scholars in Judea. The Talmud,

chief authority on Jewish history and interpretations of the law, was the work of the Pharisees. Among the prominent members of the sect was Saul, who became Saint Paul.

PHARMACY, *far'ma si*. A doctor's prescription filled at a drugstore is usually handled by a pharmacist, a person who has studied pharmacy, or the art of preparing drugs and medicines. At one time physicians filled their own prescriptions; but as years went on, the new specialized profession developed.

Today most states have strict laws in regard to who can be a pharmacist, and a license must be obtained from a special board of pharmacy. Many universities and medical schools give special courses in pharmacy, granting a degree in that field.

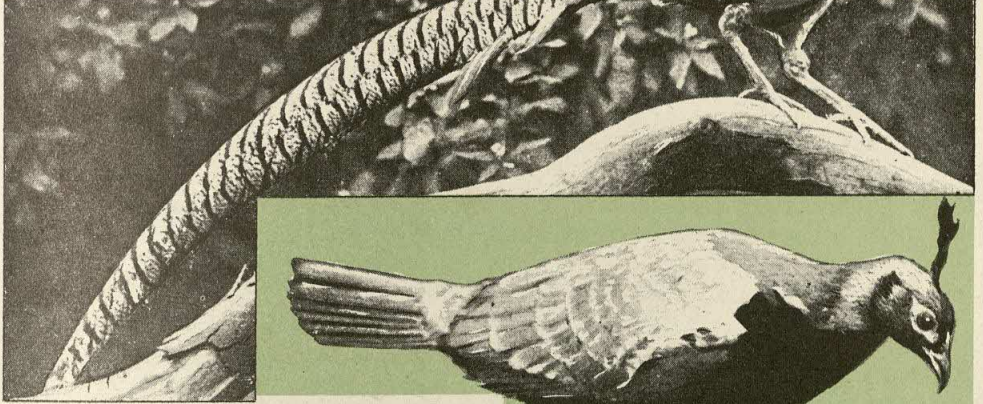
PHAROS, *fa'ros*. A peninsula jutting out into the Mediterranean and now occupied by part of the Egyptian city of Alexandria, Pharos was once an island. Here, in the 200's B.C., Ptolemy II erected a lighthouse 400 feet high, mounted on a base 100 feet square. This structure was classified as one of the Seven Wonders of the Ancient World (see that title). It was destroyed by an earthquake in the fourteenth century, after some 1,500 years of guiding the ships of mariners sailing the Mediterranean.

PHEASANT, *hez'ant*. The game fowl bearing this name are large, beautifully colored birds belonging to the same family as the domestic fowl and peacock. Pheasants originally came from Southeastern Europe and Asia, but have long been naturalized in most of temperate Europe and the British Isles. The American species is a mixture of the common Old World pheasant and the ring-necked pheasant of China. The male has a metallic blue-green head and neck, and there is always a white ring around the neck. The cheek wattles are red and without feathers. The tail is brown barred with black. A male bird weighs from two and one-half to five pounds. The female is smaller and duller-colored.

Pheasants are protected during the great-

er part of the year, but in some states the males can be shot during a short season. The flesh has a highly pleasing taste, and the pheasant has become one of our most prized game birds in favorable localities.

PHIDIAS, *fid'i as* (about 500- about 432 B. C.). Not one of the great works of art created by Phidias has survived, yet the



GORGEOUS GAME BIRDS

Magnificent plumage marks the pheasant family, yet the wild birds know well how to conceal themselves from hunters. Top, the Amherst pheasant of Tibet. Below, Himalayan monal.

world reveres this Greek master as the finest of all ancient sculptors. This fact we know because historians and critics of his and later times described his creations as perfect in beauty and superior to the excellent Greek figures that we do possess in our museums and galleries.

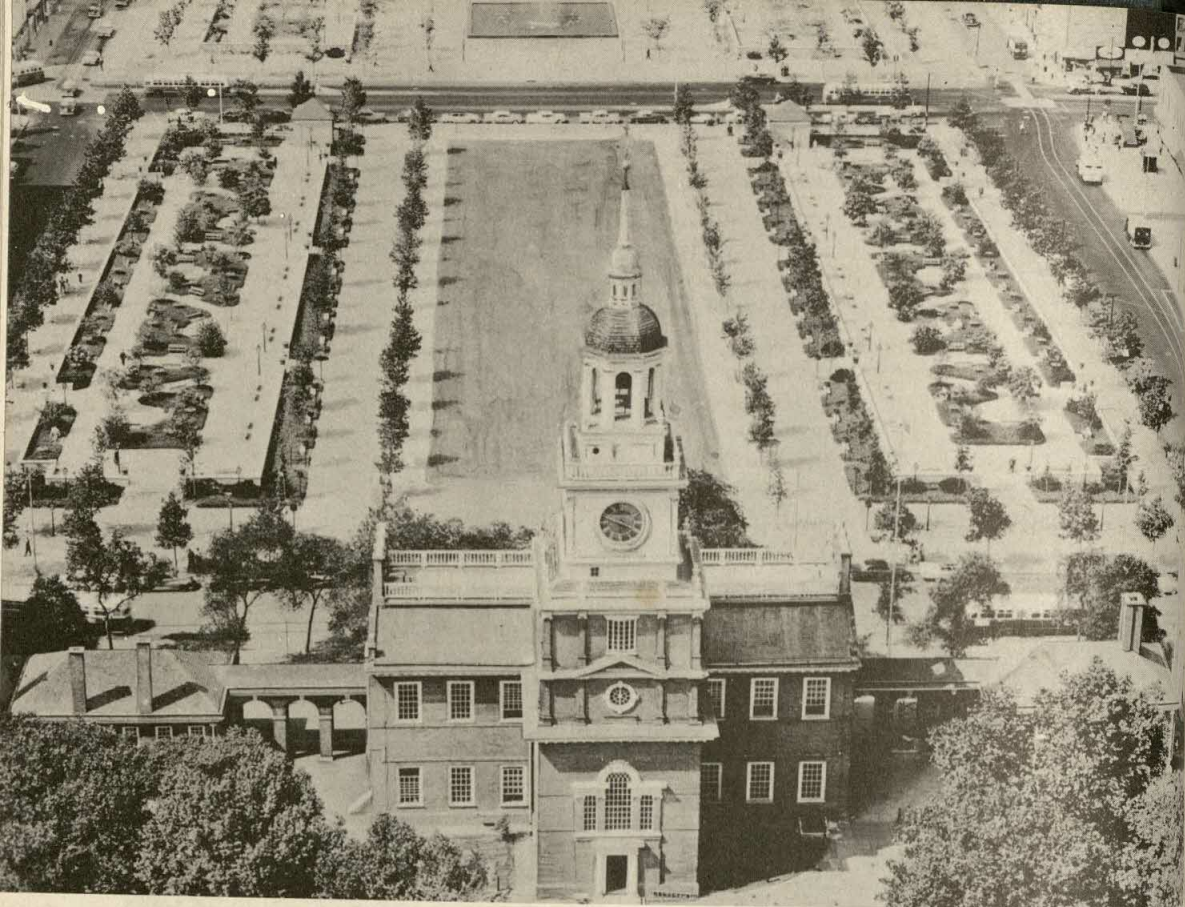
The relief sculpture of the Parthenon and the fragments of the full figures of the Parthenon pediments were designed by him, however, and these are the most treasured of relics from that famous temple. We know also that he did a large group of figures in bronze at Delphi; created the huge bronze statue of Athena which stood on the Acropolis and could be seen from afar by homeward bound Athenian sailors; and made the colossal ivory and gold figures of Athena and Zeus which stood in the Parthenon. Another ivory and gold work, the statue of Zeus at Olympia, was also his.

Phidias seldom worked in marble as most Greek sculptors did, preferring gold,

ivory, and bronze. His technique was said to be faultless, and his heroic figures are described as unexcelled. Little is known of his life, except that he was supposed to have committed sacrilege by portraying himself and Pericles on the shield of Athena in one of his statues, to have used some of the gold for his own purposes, and to have been tried for these offenses. See **PARTHENON**.

PHILADELPHIA, *fil a del'fe a*, PENNA.

In the first half of the seventeenth century, a group of Swedish colonists began a little settlement on a peninsula between the Delaware and Schuylkill rivers. The first name of the settlement was Wicaco; but when William Penn took over the province, it was changed to Philadelphia—"the city of brotherly love." Philadelphia is steeped in the tradition of early American



THE BIRTHPLACE OF A FREE NATION

Independence Hall today faces a spacious Independence Mall as part of a \$2,000,000,000 plan to beautify Philadelphia. In Independence Hall, the Congress of the rebellious American colonists declared their independence, and from it waged the Revolutionary War. In 1787, the Constitutional Convention met here to frame the Constitution under which Americans still live.

history, for it was the center of Revolutionary activity. From the close of the Revolution to 1800, Philadelphia was the capital of the new nation.

Philadelphia covers an area of about 80,000 acres and is built on three levels. The older section is the lowest of the three, and here are located the factory and business sections of the city. The second level is devoted to retail business and residences. The highest, known as West Philadelphia, is chiefly a residential area. The two main streets of the city are Market Street, which runs east and west, and Broad Street, which

runs north and south.

Buildings and Parks. Among the outstanding attractions of Philadelphia are the old, historic buildings. There is the famous Independence Hall, containing many relics of the Continental Congress and the Constitutional Convention. Other famous buildings are Carpenter's Hall, the home of Betsy Ross, Christ's Church, begun in 1727, and the building that housed the first United States Bank.

The most important of the modern buildings is the white-marble City Hall, a huge structure, topped by a thirty-seven-

foot statue of William Penn. Other large structures are the Federal buildings, the Art Museum, the Masonic Temple, the Philadelphia Saving Fund Society Building, and the Lincoln-Liberty Building.

The outstanding park is Fairmount Park, which covers 3,597 acres and contains forty-three miles of winding drives. Here are the houses of William Penn, as well as a number of other colonial homes. In this park was held the Centennial Exposition of 1876. There are nearly 150 smaller parks.

Institutions. Philadelphia has a number of widely known schools and museums. Here are located the University of Pennsylvania, Temple University, Girard College, and Drexel Institute. A short distance from the city is Bryn Mawr College.

Industry and Transportation. Philadelphia is within easy reach of the great coal, iron, and oil fields of Pennsylvania, which have contributed much to its industrial development. It is one of the leading centers for the manufacture of locomotives; streetcars, foundry products, chemicals, textiles and woollens, iron and steel products, and lumber, and for the refining of petroleum and sugar. It also has large printing, publishing, and shipbuilding industries.

The Delaware River provides an excellent harbor, lined with countless docks and wharves, which handle millions of tons of foreign commerce. Philadelphia is also an important rail and air center.

History. In 1681 the English took over the original Swedish settlement; the name was changed to Philadelphia the next year. It soon became a thriving Quaker city. A German settlement sprang up near by, and the two were later joined. The city was chartered in 1701. By 1775 Philadelphia had become the most important city in the colonies, a distinction that it held until 1825, when, with the completion of the Erie Canal, trade and commerce were deflected to New York. With the annexation of eleven towns in 1854, the city was enlarged so that it covered all Philadelphia County. Philadelphia has had two famous exposi-

tions, that of 1876 and the Sesquicentennial of 1926. It has a population of over 2,000,000, making it the fourth largest city in the United States. See PENNSYLVANIA.

PHILEMON. See BAUCIS AND PHILEMON.

PHILIP, *fil'ip*. Of an inquiring mind and loyal and zealous in the service of Christ, Philip of Bethsaida, one of the twelve apostles, is mentioned many times in the gospels. He and Andrew were entrusted with a message from the Greeks to Jesus, and these two were present at the feeding of the five thousand. Philip is thought to have been a martyr for his religion at Hierapolis in Phrygia.

PHILIP, KING. See KING PHILIP.

PHILIP II (1527-1598). In his reign of over forty years as king of Spain, Philip II, son of Charles V and Isabella of Portugal, witnessed the passing of Spain's Golden Age and the decline of an empire that covered parts of three continents. When the king came to power in 1556, Spain not only controlled the Spanish peninsula, the Low Countries, and an interest in the Holy Roman Empire, but also laid claim to most of the islands of the Pacific and nearly all of North and South America. Philip lived long enough to see many of these possessions slip away and Spain's power over the others greatly lessened. Largely responsible for this situation was the king's policy of stamping out all opposition to Roman Catholicism in Spain. His intolerance led to dissatisfaction in the Low Countries, which later revolted and eventually became independent; it alienated England and France and also caused much trouble among Philip's subjects at home.

Before Philip came to the throne, he had married Maria of Portugal; after her death, he contracted a marriage with Mary I of England, a union arranged solely for political reasons in order to strengthen the bond between Spain and England. From this marriage, Philip's father hoped to create a line of English-Spanish rulers who would control the world. This hope was blasted when Mary died childless. After



MISGUIDED MONARCH

Fearing rebellion in his Netherlands province, Philip II threatens William of Orange.

her death, Philip married Elizabeth of Valois, daughter of Henry II of France.

Philip's insistence on religious unity in Spain led to a revival of the Inquisition. His desire to make Catholicism supreme in Europe, as well as the English attacks on Spanish commerce in the Caribbean Sea, led to the launching of the "Invincible Armada" against England in 1588. In this battle, Spain was disastrously defeated and was forced to bow to England as the new mistress of the seas. Philip was succeeded by Philip III, his son by his fourth wife, Anna, daughter of Maximilian II. See ARMADA; SPAIN.

PHILIP II (382-336 B. C.). An ancient king of Macedonia and the father of Alexander the Great, Philip II was a ruthless and daring monarch whose zeal for conquest made him the master of all Greece. He was born at Pella, the son of Amyntas II. Philip was named regent for his nephew, but he soon seized the throne for himself in 359 B.C.

His plan to conquer Greece began with the capture of several of the Greek border states and an alliance with the Thebans which gave him a seat on the Amphictyonic Council. Then the onslaught on Greece proper began. Demosthenes, the famous Athenian orator, warned the Greeks of Philip's designs in his eloquent *Philippics*, but the people paid no attention to his pleas for a defensive Greek league. in 339 B.C. Philip triumphed in Thrace, then in the next year won the Battle of Chaeronea, which placed all Greece under his rule. While preparing to attack Persia, he was assassinated. See ALEXANDER THE GREAT; DEMOSTHENES.

PHILIPPINE, *fil'i peen*, **ISLANDS**. In the Pacific, some 7,000 miles west of San Francisco, lie the Philippines, a chain of nearly 7,100 tropical islands and islets. On the west, some 500 miles of the South China Sea separate them from Southeast Asia. To the north, the island of Formosa is a near neighbor; to the south lies Borneo.

Many of the islands are only tiny points of useless marshland or rock, over half of them so small that they remain unnamed. Yet 462 of them have an area of over a square mile, and eleven cover at least 1,000 square miles each. Of these, Luzon is biggest, with 40,814 square miles, and Mindanao next, with 36,906 square miles. Together, the islands cover 115,600 square miles, being about equal to Italy in size and having more than twice the land area of the Hawaiian Islands.

Geography. The biggest islands are volcanic plateaus crossed by rugged, heavily forested, mineral-rich mountains. Among these are several still-active volcanoes, including Mount Apo, on Mindanao, about—

PHILIPPINE ISLANDS

9,690 feet high, and Mount Mayon, on Luzon, rising nearly 8,000 feet.

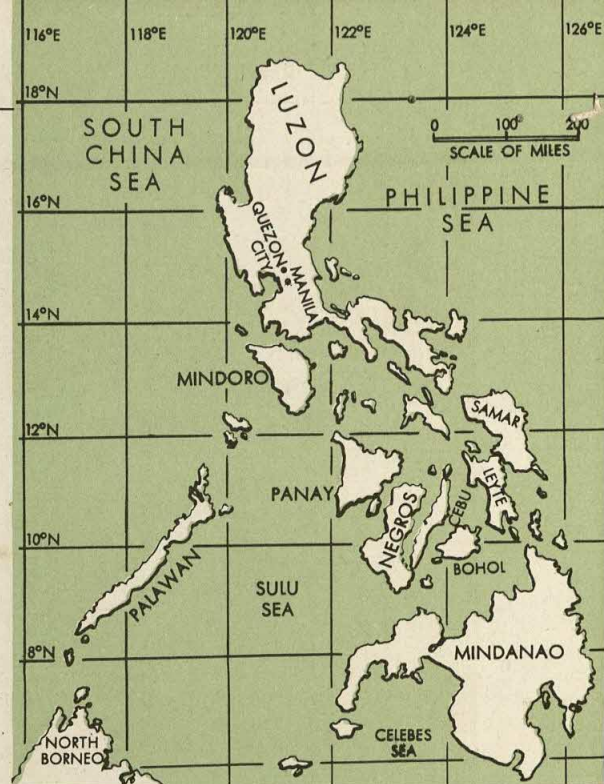
In many places the mountains rise directly from the sea, but in others wide deltas and plains fringe the coast. Inland there are also some plains and valleys, studded with lakes and threaded by rivers. It is on these fertile, well-watered lowlands that most Filipinos live. Although some rivers are navigable, many are rushing mountain streams, broken by rapids and waterfalls.

A long, irregular coastline provides many splendid harbors, the finest being at Manila, which is the best in the Orient. In some places, however, coral reefs are serious shipping hazards, and the channels are too shallow for large ships. Yet the "Mindanao Deep," one of the deepest parts of the Pacific Ocean, lies just northeast of Mindanao.

Although temperatures vary according to altitude and location, pleasant days and cool nights generally prevail. Among the mountains the thermometer may fall below freezing, but elsewhere it seldom drops below 60° F. or rises above 90°. The most pleasant season is between November and March. Then comes the hotter dry season, which lasts till June, and next the rainy season. Typhoons and earthquakes are not unusual and frequently cause great damage.

Natural Resources. The islands' forests, among the world's finest, cover about three fourths of their area. Several of the hardwoods, called "Philippine mahogany," are in great demand abroad. Other valuable forest products include gums, resins, vegetable oils, rattan, bamboo, tanbarks, dye-woods, gutta-percha, medicinal plants, and orchids. Also valuable is the coarse native cogón grass that covers millions of acres, providing pasturage for livestock. Various palms and other native plants produce fibers for making many products, and an abundance of brilliantly colored wild flowers and ferns adds to the beauty of the scenery.

Among the many animals are monkeys,

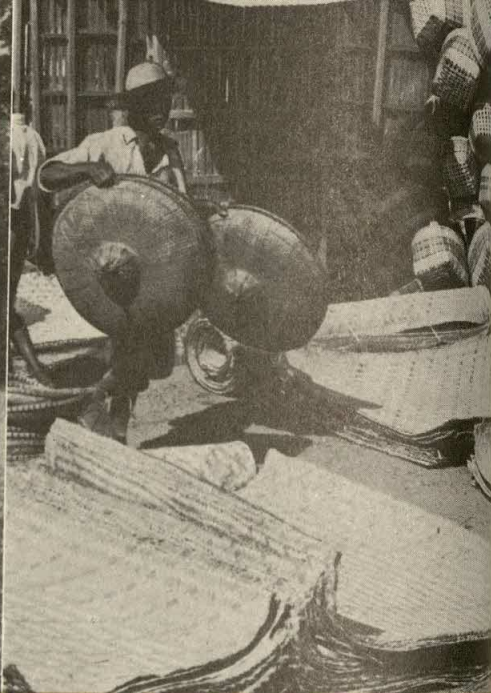


fruit bats, flying lemurs and squirrels, unusual land snails, the tiny mouse deer and other species of deer, wild hogs and water buffaloes, and the mongoose and civet. Brightly colored butterflies, moths, and birds, including parrots, hornbills, and jungle fowls, are abundant. So, too, are pythons and other snakes, crocodiles, and countless kinds of lizards.

Philippine coastal water and rivers teem with nearly 2,000 species of fish, making fishing a leading industry. In the encircling seas, whales, porpoises, and dugongs, sponges, pearls, and mother-of-pearl also are found.

Among the islands' many rich minerals are gold, silver, chromite, copper, iron, and manganese, all mined on a small scale. Other mineral products include salt, some coal and oil, asbestos, gypsum, sulphur, asphalt, and fine building stones. Uranium has been discovered there.

Industries. Farming is the leading industry, rice being the chief food crop raised. Rice and fish are the country's basic foods. Most of the world's "Manila hemp," or abaca, a valued fiber, comes



Pan American Airways System

FERTILE FIELDS AND BUSY MARKETS IN THE ISLANDS
At left, Filipinos harvest the rice. At right, woven mats, hats, and baskets go on sale.

from Philippine plantations. The islands' palm trees, both wild and plantation-cultivated, are a top supplier of coconut products. Other important crops include sugar cane, corn, tobacco, cotton, maguey, coffee, rubber, nuts, and fruits, especially pineapples and bananas. Island livestock includes many carabaos (see CARABAO), the principal beast of burden, ponies, cattle, goats, sheep, hogs, and poultry.

Although badly damaged during World War II and still in their infancy, Philippine industries include sugar refining, pineapple canning, coconut processing, and the manufacture of cordage, embroideries, cigars, cigarettes, rattan furniture, pearl buttons, and cement. The people are noted for their many handicrafts. In their own homes they make hats, mats, embroideries, laces, wood carvings, and rattan products.

Transportation. Naturally, much of the trade among the islands is by water, as is that between the Philippines and the outside world. Nevertheless, domestic and foreign air service is very important. There are about 800 miles of railroads on Luzon,

Panay, and Cebu, and thousands of miles of good roads. Although buses and automobiles are used, two-wheeled *carretelas* and *carromatas*, pulled by carabaos or ponies, are much more common than motor vehicles.

The People. The islands have an estimated population of 24 million. Despite the hardships suffered during World War II, the people of the Philippines rapidly learned their obligations as citizens of a young republic.

About eight million people of the islands speak English though there are many different native languages and dialects and Spanish is spoken by the older Filipinos. Tagalog became the country's official language in 1946 and is spoken on the radio, in schools, and in motion pictures. Visayan is spoken by the people who inhabit the central islands around the Visayan Sea.

Farmers make up 90 per cent of the population of all the islands. These people have homes made mostly of bamboo which are raised off the ground to allow for quartering of animals beneath. Despite

an outward appearance of backwardness, the farmers have played an active part in the country's build-up of democracy.

Filipinos are largely of Asiatic descent but have a distinctive physical appearance. The great majority are devout Catholics. Illiteracy is disappearing because of the American education policy followed before the granting of independence and still in practice.

Cities. Manila is the largest city and chief seaport. Quezon City, to the northeast, replaced it as the capital in 1948. Baguio, in the mountains, is the official summer capital. Cebu, Iloilo, Zamboanga, and Davao are other major port cities.

Government. The government of the Republic of the Philippines is similar to that of the United States. Executive power is held by a President and a Vice-President, elected for four-year terms. There is a cabinet of department heads, a Senate and a House of Representatives. The United States maintains bases in the islands and helps train and equip Philippine defense forces.

History. Discovered by Magellan in 1521, the Philippines were named after Prince Philip, later King Philip II, of Spain. The Spaniards established a permanent colony at Cebu in 1565 and founded Manila in 1571. For more than three centuries they exploited the islands, crushed revolts, and fought off foreign invaders. Then, in 1898, during the Spanish-American War, a United States naval force under Admiral George Dewey defeated the Spaniards in the Battle of Manila Bay. When the war ended, Spain ceded the islands to America in return for \$20,000,000. Though inexperienced in colonial management, the United States set out to make this new possession a "show window of democracy." After subduing the independence-demanding guerrillas in the hills, they established a civil government and set out to give the people schools, medical attention, and a higher standard of living, and to prepare them for self-rule. In 1934 the United States promised independence

in 1946, and in the next year the Philippine Commonwealth was established, under which the islanders practically ruled themselves.

An attack by Japan, feared for a long time, came in late 1941. American and Filipino forces, fighting heroically at Bataan and Corregidor, were driven from the islands until 1944 when General MacArthur kept his promise to return with forces of liberation. The islands became the Republic of the Philippines on July 4, 1946.

The nation set about repairing its war damage at once. Communist-led guerrillas called Huks were broken up with offers of land and equipment to start farming. They had been landless peasants roused by agitators but their movement lost strength with the surrender of the Huk leaders in 1954. The United States was granted military bases in the islands and extended various aids in return. These included a reduction of tariff rates on Filipino goods. In 1956, Japan and the Philippines signed an economic agreement. See MAGELLAN, FERDINAND; MANILA; SPANISH-AMERICAN WAR; WORLD WAR II.

PHILISTINES, *fil is'tinz*. The Philistines, Old Testament foes of the Israelites, were a tribe of mixed ancestry who lived on the western coast of Palestine. Their chief cities formed a confederation ruled by five chiefs.

PHILLIPS, WENDELL (1811-1884). Although graduated from Harvard's law school and admitted to the bar, Boston-born Wendell Phillips spent most of his life lecturing and working for various causes. His orations against slavery made him an outstanding abolitionist leader. After the War between the States, this great reformer championed temperance, woman's suffrage, fair treatment for Indians, prison reform, and the labor movement. His best-remembered addresses include *Toussaint L'Ouverture*, *The Lost Arts*, and *The Scholar in a Republic*.

PHILOLOGY, *fil ol'o ji*. See LANGUAGES OF THE WORLD.



IN SEARCH OF TRUTH

The scholars of ancient Greece had a special gift for philosophic thinking. They formed the School of Athens (above). Left, Aristotle. Right, Plato.

PHILOSOPHY, *fil os' o fi*. Every science we know and use today has sprung from philosophy. Philosophy has nourished mathematics, physics, chemistry, biology, and sociology—to name only a few sciences. Psychology is one of the latest to become a separate science. All, however, are still bound to philosophy, for it is to philosophy that each of the others owes its existence.

Philosophy received its start from the Greeks. The term, meaning *love of wisdom*, was invented by them, and they formulated the different methods of approach which all philosophers have since followed. The Greeks had an astounding curiosity. They wanted to know the *why* of everything. They asked, "What am I?" "What causes things to be?" "What is life?" "What is truth?" Men like Thales, Socrates, Plato, Aristotle, and others tried to answer and thus built the foundations of philosophy and science.

The Greeks developed two important schools of philosophy. One was known as the *epicurean* school, the other as the *stoic*.

The epicureans believed that pleasure is the true good; the stoics held that virtue is the only true good. The Romans combined these two schools into the *eclectic* system, of which Cicero was an adherent.

During the Middle Ages a belief called *scholasticism* grew up. It was the application of logic to church doctrines, holding that through logical reasoning there must be a Divine Being. Abelard and Saint Thomas Aquinas were among the noted advocates of this philosophy.

After the Renaissance, philosophy began to assume its modern forms. One system, advocated by Descartes, was called the *deductive* process, which held that conclusions are reached from principles assumed to be true. Geometry is a science that uses this system. A proposition is given which is known to be true. Then a particular problem is solved by applying this principle.

Opposed to this process was the *inductive* system, sponsored by Francis Bacon. It held that truth must be discovered. Therefore, observation and experimentation are neces-

sary to arrive at a conclusion. For example, Galileo dropped two balls of unequal weight from a tower. He found that they fell to the ground at the same time. Thus he conducted an experiment to arrive at a truth. The inductive method is the basis of scientific research.

These two systems of philosophy have been studied and used as a basis for reasoning by philosophers ever since. The trend, since the time of Immanuel Kant, has been toward critical philosophy in which the "mother of all sciences" has become a science in itself. Some philosophers have combined the inductive and deductive processes. Education today is such a combination.

Some of the leading philosophers since the time of Descartes and Bacon are Spencer, Darwin, John Stuart Mill, Locke, Hume, Berkeley, Cousin, Voltaire, Bergson, Hegel, Kant, Herbart, Lotze, Nietzsche, Spinoza, Schopenhauer, Spengler, Emerson, William James, John Dewey, and Santayana.

For additional information, consult the following articles:

Aristotle	Locke, John
Bacon, Francis	Plato
Emerson, Ralph W.	Socrates



A CHARMING ANNUAL

Phlox make a brave show of brilliant colors.

PHLOX, *flox*s. So varicolored are the flowers of the phlox genus that they might well be called "rainbow" flowers. These beautiful annual and perennial herbs derive their name from the Greek word meaning

flamelike, probably applied to a special variety of flame-colored phlox. Those of today bloom in a mass of whites, lavenders, pinks, purples, and scarlets. The annual, or *Drummond's*, phlox is a native of Texas, and its blossoms range from red through purple to white. A few varieties have been developed that grow to a height of six or seven feet.



PHOEBE, OR WATER PEWEE

Phoebes often build their nests near water.

PHOEBE, *fe'be*, or **PE'WEE**. A friendly little bird of the flycatcher family, the phoebe is nearly seven inches long, dark brown above, light below, and without distinct markings. It has a habit of bobbing its tail when on a perch, and of uttering its name *phoebe*, *phoebe* in an earnest though unmusical way.

PHOENICIA, *fe nish'i ah*. First to sail the seas in search of trade and wealth, the Phoenicians were among the great people of the Mediterranean who contributed to the civilizations of later days. Everywhere throughout the Mediterranean, the blue and purple sails of their ships could be seen as these enterprising Semitic people traded glass, metal articles, cloth, and dyed goods for Arabia's frankincense, gold, and pearls, or Africa's ivory and slaves, or Spain's silver, or Cyprus's copper. For tin they even went to the Scilly Islands, once thought to have been part of the mainland of England.



VERSATILE WERE THE SONS OF TYRE AND SIDON

Boldest navigators and smartest traders of the ancient world, the Phoenicians developed many crafts and customs we inherit. Left, Phoenician vessel. Right, an example of their art.

Their system of writing, which eventually became the alphabet we possess today, was given to the Greeks. They spread the arts of making glass, beautiful pottery, and metal ornaments and utensils. The Tyrian purple dye used for the robes of royalty was made by the Phoenicians from a substance obtained from murex, a shellfish inhabiting the Mediterranean waters.

As Semites, the Phoenicians were closely related to the Jews, their neighbors and sometimes their enemies. They were an ancient people, but nowhere in their long history do we find any record of a military or political organization. They governed themselves somewhat as the Greeks did in later years—in city states. These were located on the eastern Mediterranean coast extending from Mount Carmel to the Eleutherus River, and from the Mediterranean to the Lebanon Mountains. Their greatest cities were Tyre, Sidon, and Byblus.

Because they were weak politically and had no military strength, the Phoenicians were conquered by the Egyptians, the Assyrians, Chaldeans, and Persians; but since

their ships were always needed, they always maintained their economic freedom until Alexander the Great conquered them in 332 B. C.

The religion of the Phoenicians consisted of the worship of many gods—the gods of the mountains, rivers, fields, sun, moon, and others. Baal was the name for a god, and there were many baals. The moon goddess Astarte came to be generally worshiped. Temples were built, and at times human sacrifices were offered, particularly of children. They planted colonies throughout the Mediterranean, one of them being the city of Carthage, which for many years was the great foe of Rome.

For additional information, consult the following articles:

Alphabet
Carthage

Sidon
Tyre

PHOENIX, *fé'niks*, ARIZ. Situated in the center of a vast fruit-growing valley which contains the great Roosevelt Dam, Phoenix is the principal city and capital of Arizona. It is a modern city that serves as the chief market for the fruit, olives, honey, cotton,

hay, grain, dairy products, and livestock of the surrounding region. The leading manufactures are machine-shop and meat-packing products. Copper deposits in the near-by mountains form the basis of a well-developed copper-refining industry.

Many visitors come to Phoenix each year to spend their vacations, attracted by the ruins of an ancient Indian civilization, which are within easy reach of Phoenix, and by the interesting scenery of the area. Its clear, dry climate has made the city an important winter resort, and the Salt River irrigation system has turned the surrounding "Valley of the Sun" into a prosperous agricultural area. Phoenix was founded in 1870 and was incorporated as a city in 1881. Phoenix proper has about 435,000 inhabitants; metropolitan Phoenix, about 660,000.

PHONETICS, *fə net'iks*. All correct speech and oral reading depend upon the proper application of phonetics. In its broadest sense, phonetics includes all sounds made by the human voice; more exactly it consists of the correct pronunciation of the vowels and consonants and the numerous combinations of the two. There are two general types of vocal sounds in normal speech: those which are produced merely by vibrations of the vocal cords, and those which are produced by combining the use of the vocal cords with the use of the teeth, tongue, palate, and lips. The first group consists of the five vowels, *a*, *e*, *i*, *o* and *u*; the other group is made up of the consonants.

The twenty-six letters of the English alphabet must serve to represent forty fundamental sounds. Some of the letters, therefore, must represent more than one sound, making the language one of the most difficult for foreigners and young children to learn.

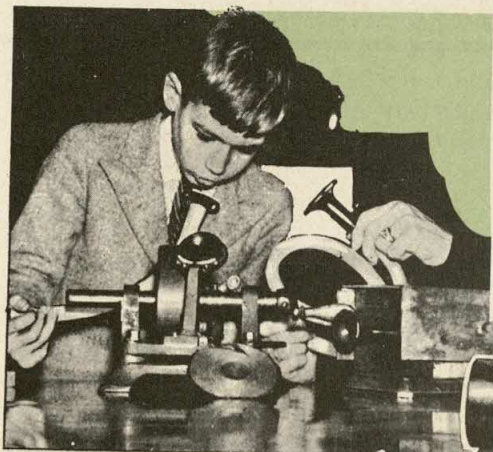
Phonics. As a basis for reading, beginners in the primary grades are often taught the letters and the proper sounds to be associated with each. In some schools, however, instruction begins with complete sentences. The former system, which includes the

coupling of certain consonants, such as *ch*, *ck*, and *fl*, and of consonants and vowels, such as *ha*, *te*, *mo*, and *bi*, makes up the study of phonics. For a full description of methods, important sounds of letters and combinations, and the methods of handling special difficulties, reference to various primary and first-grade readers is advised. See **ORTHOGRAPHY**.

PHONOGRAPH, *fən'o graf*. Very crude was the first phonograph, or talking machine, invented by Thomas A. Edison in 1877. It grew out of the knowledge which scientists had gained of the fact that sounds are different kinds of vibration (see **SOUND**), but their machines were not successful until a new type of knowledge had been gained from experience, a knowledge of the materials and methods best suited to the invention. Edison's first machine scratched a record on a cylinder covered with tinfoil. Most phonograph records are now flat discs of waxlike material or plastic. Some are ribbons, tapes, or wires of such length that the longest symphony or speech can be "played" without change of records.

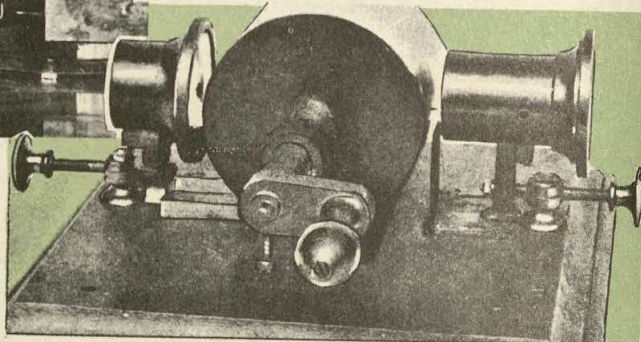
In any case, the principle is the same. First, a record is made on a recording instrument. The sound to be recorded causes the vibration of an elastic diaphragm, as in the telephone. This diaphragm moves a needle which cuts a groove in a moving cylinder, disc, or ribbon, the record. This record is then covered with metal by electric action, and becomes the matrix, or mother record, from which thousands of others can be made. When one of these duplicates is put in a phonograph, the action is the reverse of that which takes place in the recording. The needle, as it follows the groove, causes the diaphragm to vibrate, and the vibrations of the diaphragm cause vibrations in the air, which are the sounds we hear.

Variations of the phonograph, such as the *dictaphone*, are used to make business records. Phonograph records not only preserve fine musical performances, but are of value to those who cannot read, and are used to provide the blind with news and instruction. Radio recording and reproduction



TWO FAMOUS FIRSTS

Both these devices have been called "the first successful talking machine." Above, fifty-six years after being sealed and placed in the Smithsonian Institution, Bell's model is inspected. Right, original Edison machine.



methods have greatly improved the quality of phonograph performance.

PHOSPHATES, *fahs'fates*. In chemistry, when phosphoric acid is combined with certain elements, the resulting products are called phosphates. They are found in nature as phosphate rock, usually as calcium phosphate. Other sources are animal bones, vegetable molds, and guano. Required for animal and plant growth, phosphates are invaluable fertilizers and have many other uses. See URANIUM.

PHOSPHORESCENCE, *fos for es'ens*. In contact with the air, yellow phosphorus gives off fumes which emit light, especially visible in a dark room. Because the property of emitting light by bodies not in themselves luminous was first observed with phosphorus, the process received its name of phosphorescence. This process is one of slow oxidation and the energy liberated appears as light.

Many organisms, such as the firefly and smaller creatures, give off light that is "cold," but this is not phosphorescence in a scientific sense. Phosphorus is not involved in this phenomenon (see FIREFLY). Luminosity of the sea in summer, of driftwood,

of "fox fire" (decaying wood), and of food-stuffs fall in this class, the effect most often being due to the presence of certain kinds of bacteria.

Sulphides of calcium and other elements, cobalt phosphate, etc., if exposed to intense light, will continue to give off light in the dark for some time. The explanation of this phenomenon is that the intense light sets up such a rapid motion of the molecules

which compose the substances, that, when placed in the dark, the motion of the molecules is changed to light energy. Luminous paints contain these substances (see RADIUM).

PHOSPHORIC, *fos for'ik*, **ACID**. When phosphorus pentoxide (a compound of phosphorus with five atoms of oxygen) is added to water, or when it is exposed to moist air, a sticky jelly-like substance called *metaphosphoric acid* is produced. It is frequently called *glacial phosphoric acid*. When metaphosphoric acid is allowed to stand dissolved in water, it slowly changes to the more common *orthophosphoric acid*. The change takes place more rapidly if the solution is boiled. This orthophosphoric acid is what is commonly called *phosphoric acid*.

In the dry form, phosphoric acid melts at 38°C. (100°F.). It usually comes on the market as a thick, syrupy liquid containing about eighty-five per cent of the acid. It forms three series of salts. See PHOSPHORUS.

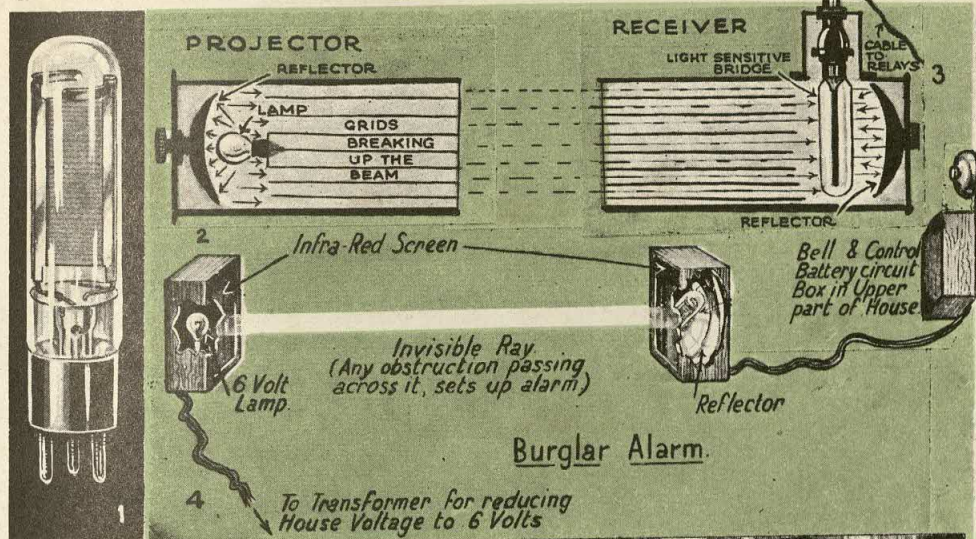
PHOSPHORUS, *fos' for us*. This non-metallic element occurs commonly in two different forms, the yellow and the red. Its symbol is *P*.

The yellow phosphorus can be cut like wax, is insoluble in water, and dissolves readily in carbon bisulphide. It is very poisonous, and when matches were made from it, the workers frequently contracted bone diseases. Phosphorus matches are no longer manufactured in the United States. In contact with air at ordinary temperatures, yellow phosphorus emits fumes which send out light visible in the dark (see PHOSPHORESCENCE). When exposed to air at 95°F. it ignites, and is kept under water to prevent

spontaneous combustion. Burns caused by it are difficult to heal. Phosphorus is used in the preparation of the chemicals for smoke screens.

Because phosphorus is essential to plant and animal growth, it is added to soil in the form of phosphate fertilizers.

Red phosphorus is produced by heating yellow phosphorus. It is not nearly so active as the yellow variety, does not unite with oxygen unless heated, is not soluble in carbon disulphide, and is not poisonous.



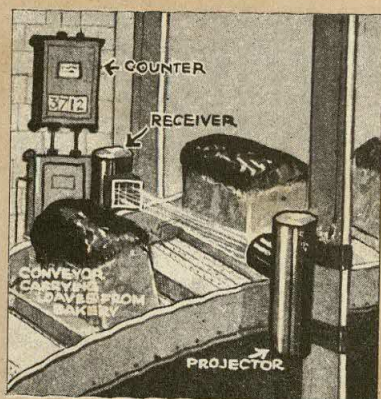
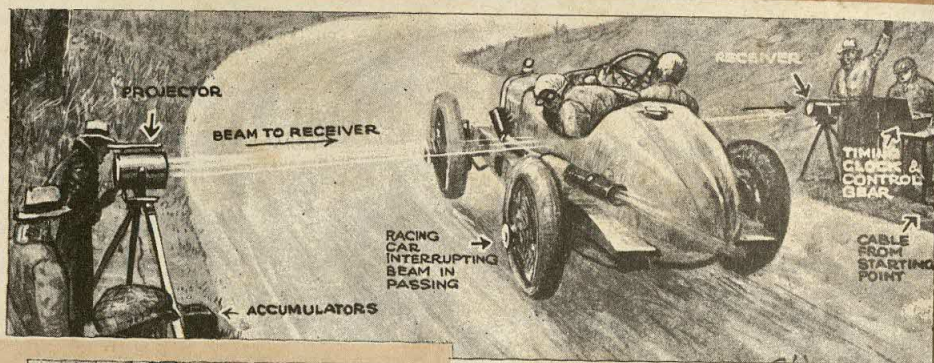
PHOTOELECTRIC, *fo toh e lek'trik*, **CELL**. Magic more astounding than that of the most fanciful Oriental mystics is accomplished every day in a myriad of ways by the photoelectric cell, a device that makes possible the conversion of light into electric energy. It will operate a drinking fountain; open and close doors; time a race, or photograph a close finish; or sort, inspect, and count manufactured articles moving along an endless belt. It is a vital part of motion-picture sound-reproduction equipment and of television apparatus, and is used for safety protection of machines; as an alarm in case of burglars, fire, or other emergency; for candling eggs; in traffic safety devices; and any number of industries and professional fields.

The photoelectric cell, also called the



HOW THE ELECTRIC EYE WORKS ITS MODERN MIRACLES

Light never fails in the service of mankind when put to work through the agency of the photoelectric cell. (1) One form of phototube. (2) An electric lamp casting a concentrated beam of light and (3) a receiver for focusing the beam on a tube. (4) Burglar alarm actuated by a selenium cell and an invisible ray which (5), if obstructed, lets cell ring bell.



ODD JOBS FOR THE SEEING CELL

Automobile, horse, dog, and human races can be accurately timed with the unblinking electric eye. Left, cell counting loaves on conveyor.

cell, setting up a current which keeps the fountain shut off, or the door closed. When the beam is broken by a person leaning over to obtain a drink, or a person approaching the door, the current is interrupted and the water spouts from the fountain, or the door opens. This process may be reversed very simply.

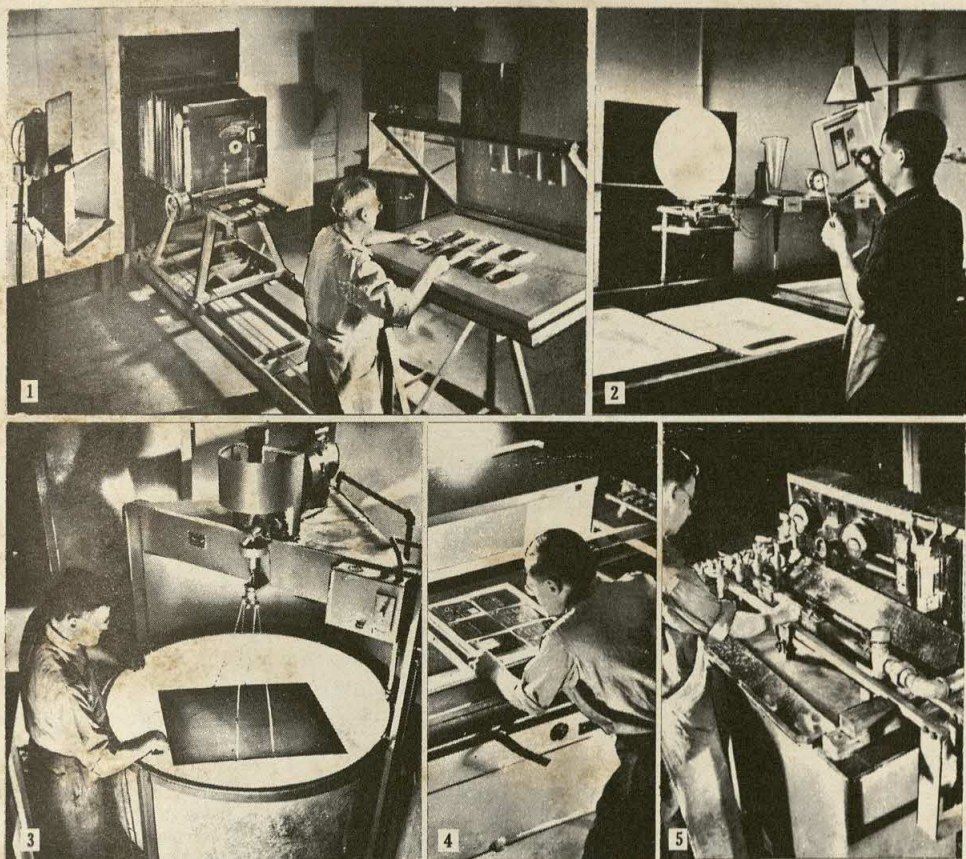
In timing devices, the beam sets up a current in the cell which operates a watch. The beam begins to focus on the cell immediately at the start of the race. As soon as the beam is broken by the runner, horse, or automobile crossing the finish line, the current is broken, the watch stops, and the accurate time of the race is registered. The sensitivity of the cell to color reflection makes it useful in sorting unlabeled goods from labeled goods, or imperfect cigars, paper, etc., from satisfactory products.

A photoelectric cell usually resembles the vacuum tube used in radio receivers, with a mounted filament. The inside of the glass is coated, except for a small opening, with some light-sensitive element such as sodium or metallic potassium. The tube may either be a vacuum or be filled with a gas. When a beam of light is thrown upon the cell, it causes the potassium or other element to give off electrons which move to the filament, thus forming a weak current which is stepped up by transformers to sufficient power to perform the task set for the cell.

In the case of drinking fountains, doors, etc., this beam of light shines steadily on the

PHOTO-ENGRAVING. In making illustrations for newspapers and magazines, photography plays an important part. There are several methods of photo-engraving in which pictures are transferred onto metal plates by photographic methods and then etched. Ordinary photographs are reproduced by the halftone process, and pen drawings and less complex pictures by ordinary zinc etching.

Making Halftones. Most of the illustrations in this book have been made by



Courtesy Pontiac Engraving and Electrotype Co.

MAKING THE PLATES THAT PICTURIZE PRINTING

Expert photo-engravers make plates that faithfully reproduce every detail of tone and texture visible in the "copy," or original picture. (1) The camera. (2) Developing the negative. (3) Sensitizing metal. (4) Printing image on metal. (5) Etching the plate.

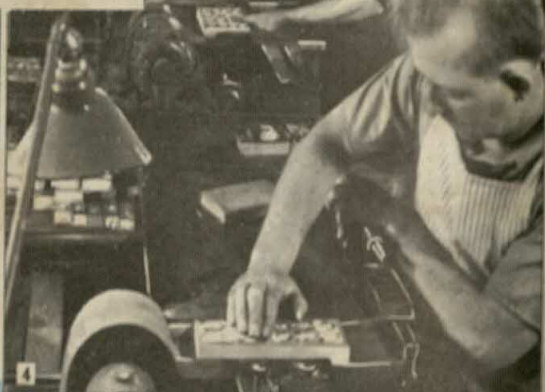
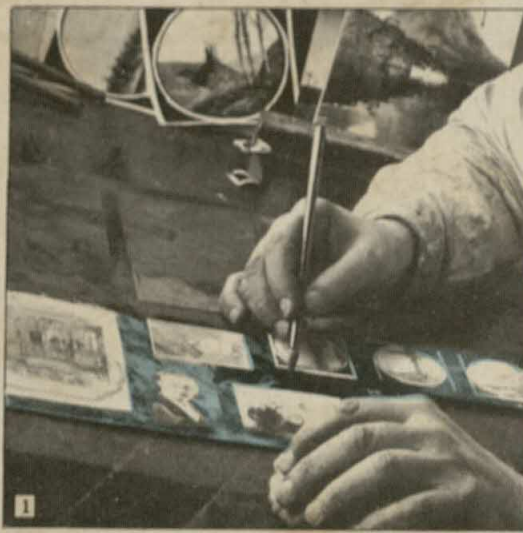
the halftone process. Examine a picture closely with a magnifying glass, and you will find it composed of many small dots varying in size. The size of the dots determines the highlights and shadows of the picture.

Photographs are generally reproduced by this process, because it is only in this manner that the middle tones (that is, half, or intermediate, tones) in the picture can be broken up so that they will print.

The first step in making a halftone consists of photographing the picture through a screen. This screen is composed of two glass plates, each with many finely ruled parallel lines running diagonally across the

face. The lines are filled in to make them opaque, and the plates are cemented together in opposite directions so that the diagonal lines cross each other. These screens, when placed in contact with the plate upon which the negative is to be made, break the picture up into tiny squares and produce the small dots. The negative, being the reverse of the picture, causes all black lines in the screen to appear white and produces the effect of black dots. The smaller the dot, the lighter that portion of the picture will be, and in this manner, the lights, shadows, and middle tones are reproduced.

The coarseness or fineness of the screen



Courtesy Jahn and Ollivier Engraving Co.

SKILLED HANDS AID MACHINES

Despite the efficiency of modern machinery, photo-engravers must employ skilled handwork. (1) "Staging" and hand etching. (2) Finishing. (3) Routing. (4) Mounting. (5) Final proofing.

to be used varies with the surface of the paper upon which the picture is to be printed. Thus, a coarse screen, sixty lines to the inch, might be used for illustrations in a newspaper, while a 133-line screen would be used in books such as this.

The negative is placed on a copper plate which has been covered with a thin film of sensitized coating that hardens where exposed to light. The negative produces a picture on the plate in much the same man-





A



B



C



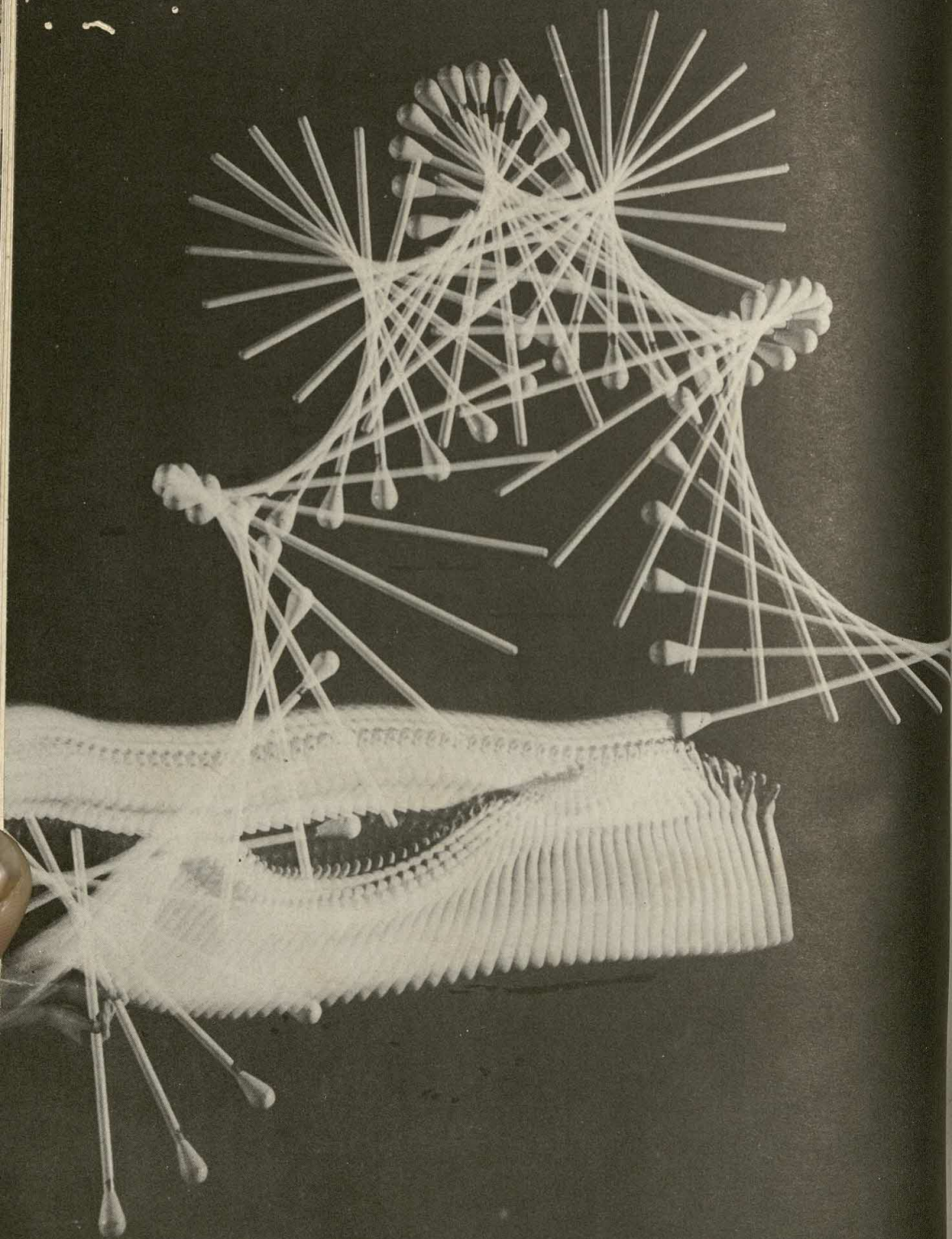
D



E

FULL-COLOR REPRODUCTIONS BY THE MILLION

Paintings and pictures once could not be reproduced except by hand copying; couldn't be printed at all. Today, photo-engraving makes high-speed printing in full colors a practical art, based on the fact that three primary colors—red, yellow, and blue—will form all others. Three photographs are taken through color filters. Then engravings are made from each negative. In the press the three are printed in the proper inks, one after the other, and the combined impressions complete the picture. A, B, and D are the primaries. E is B over A. And C is the final product. D added.



A PHOTOGRAPHER'S STUNT

Harold E. Edgerton

The use of stroboscopic flash equipment with the camera makes possible this multiple picture of a drum major's baton being thrown into the air.

ner as photographs are made. When the plate is washed, the sensitive film not affected by the light is washed away, and the plate is then heated to form an acid-resisting enamel. The copper plate is now placed in an acid bath to be etched. When this is completed and the plate cleaned, the "cut," as it is called, is ready for printing.

For additional information, consult the following articles:

Engraving
Etching

Photography
Zinc Etching

PHOTOGRAPHIC, *fotoh graf'ik*, SURVEYING. Large cameras, specially equipped for the purpose, are used by many surveyors today to map large areas of land from aircraft. Particularly is this true in places which are difficult to cross by land. The camera is equipped with a leveling apparatus and cross wires. Two or more stations are selected, the base line is measured, and the camera photographs the area which can be accurately mapped from the known dimensions.

Photographic mapping by airplane has come into wide use. The camera is set in the floor of the plane, and is set to click a picture automatically every specified number of seconds. The plane flies in a straight line at a definite altitude and at a certain speed adjusted to the camera. The result is an accurate mapping of a large area in a short space of time.



PHOTOGRAPHY, *fo tog'ra fi*. Civilization's most vivid means of recording pictorial scenes is photography. Serving many useful purposes, it provides a means of preserving scenes that, in usual circumstances, can never again be duplicated. In conjunction with the microscope, it aids science in



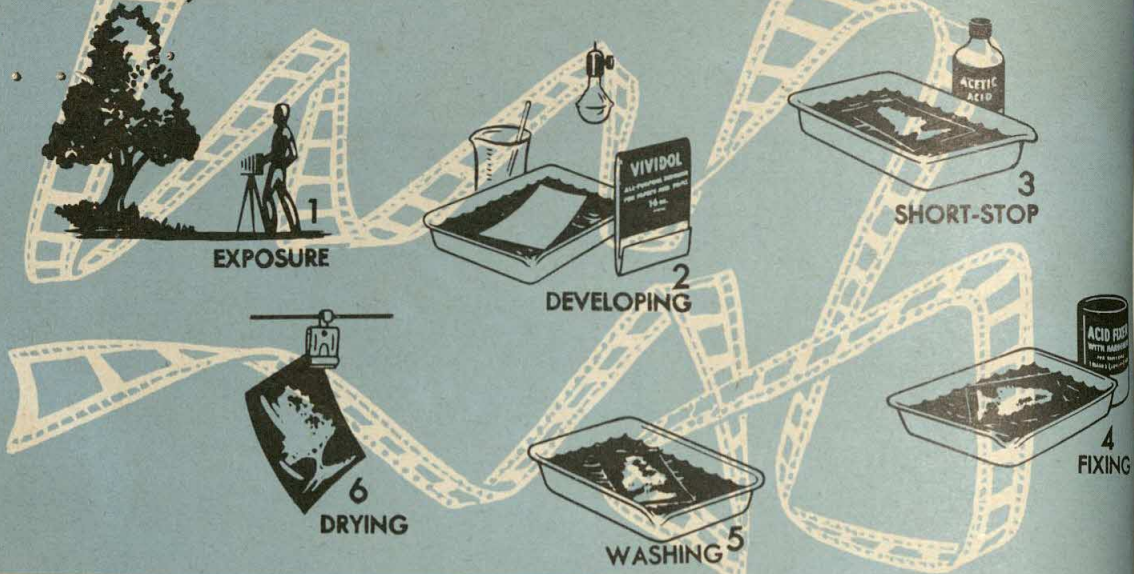
MAKING PICTURES WITH METAL DOTS

Above is a section of a halftone print enlarged six times (1) from the fifty-five-line screen proof at (2). (3) The area which was enlarged. Note that the dots are much smaller in light parts of picture. (4) Greatly enlarged section of halftone.

persistent research into minute animal and plant life and, with the telescope, in the study of the stars. It is used for aerial mapping and for educational and advertising purposes. In addition, photography provides some of the most interesting features of newspapers, magazines and books. The skilled cameramen of the moving-picture industry have also used photography to bring us news and entertainment.

How a Photograph Is Made. Three processes comprise photography: exposing the film, developing it, and printing. The picture is taken on highly sensitized gelatin emulsion containing silver bromide which is spread on one side of transparent film or glass. This material is very sensitive to light. In taking the picture, care must be used in the amount of light per-

How a negative is made



HERE'S HOW!

Anso

Above, the steps to be taken in making a negative. At right, the inset diagram shows how this indoor picture was taken by daylight.

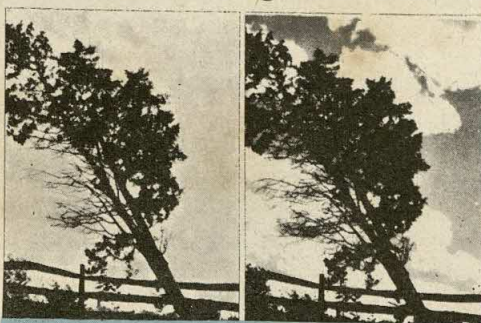
mitted to affect the film. The camera should be focused accurately; the lighting, whether out of doors or inside, should be right, and the amount of time the film must be exposed should be considered. Snapshots and flashlight photographs are usually taken at from one-fifth to one-two hundredth of a second, while views taken at night or on dark days are usually time exposures.

The development of pictures must be undertaken in a dark room, so-called because no white light from any source is allowed to enter while the film is being developed. If such a light falls on the film



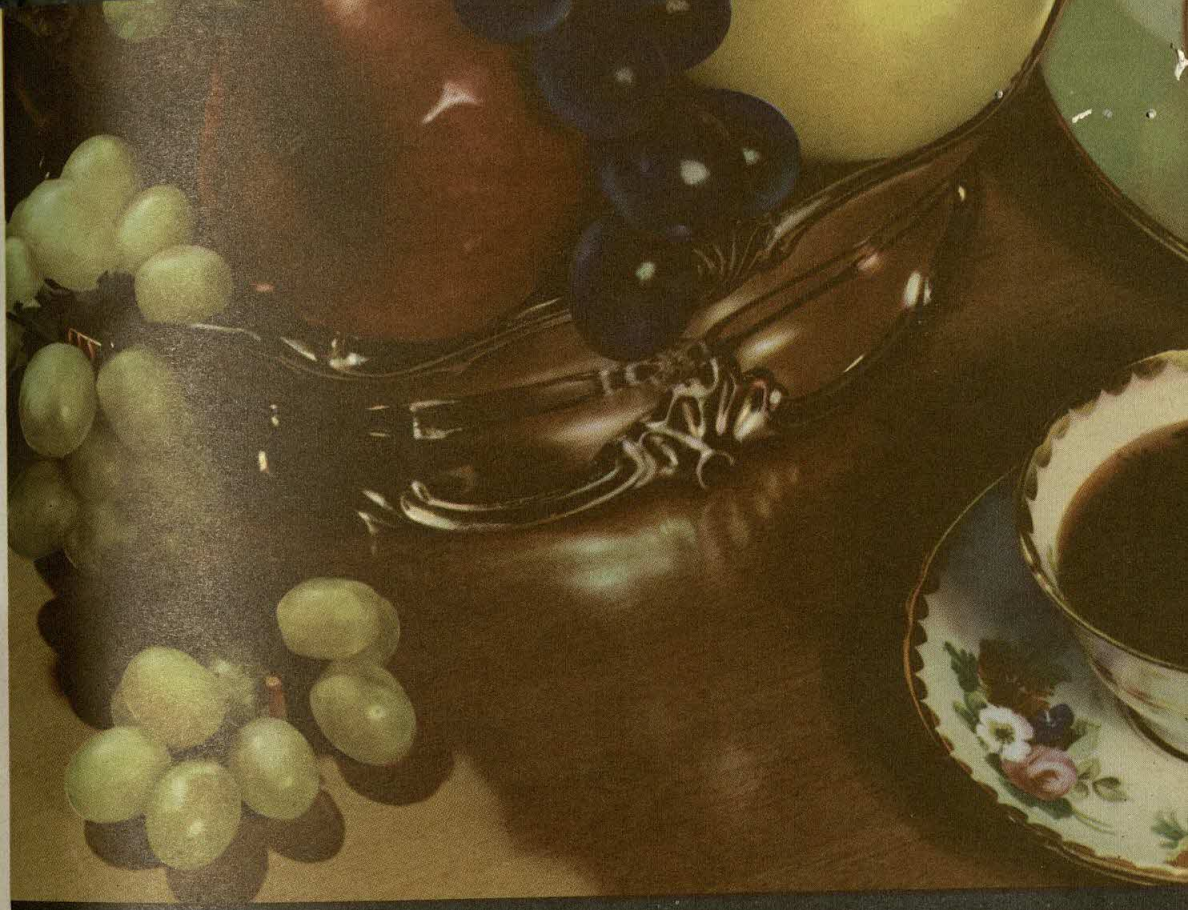
before it is developed, the picture is ruined. A red- or orange-colored light in the dark room, however, will not seriously affect ordinary film, which is called *orthochromatic*. *Panchromatic* film, however, must be handled only in absolute darkness or under special safe light.

When the film is taken out of the camera, it is laid in a shallow tray in which the developer has been poured. The film is immersed and kept moving in the tray so that all parts are evenly washed by the solution. As the developer takes effect, it acts on the particles of silver bromide which have been decomposed by exposure to light, and dissolves the bromine, leaving finely



DRAMATIC CLOUD EFFECTS

Landscapes are more effective when they show clouds. Left, plain shot. Right, with filter.



Courtesy Harris-Seybold Company

LIVING COLOR

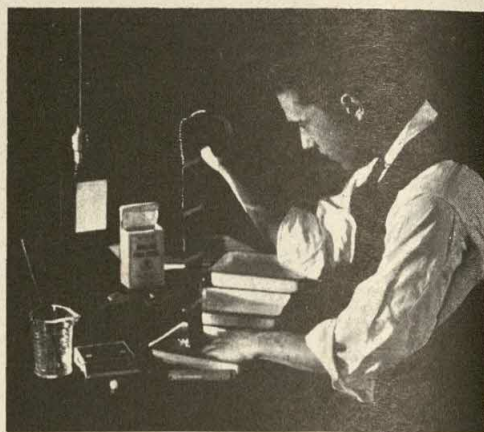
The beauty of natural colors seems to come alive in excellent color photography. More lighting is necessary than with black and white photography, and there are fewer highlights. However, the grain of the wood in the shadow illustrates how brightness in color photography affects surface texture. It also brings out the sheen of the silver and china, and the natural texture of the skins of the fruits.

divided silver, which is black. Thus the lights and shades of the picture appear, and when they are all visible, the film is placed in cold water, then immersed in a solution of hyposulphite of soda. This "hypo," or fixing solution, dissolves portions of the silver bromide which did not receive enough light energy to become decomposed during the limited time of immersion in the developer. The negative, as the developed film is called, is then washed, dried, and made ready for printing.

The negative shows the lights and shadows in reverse, and in order to make

the picture appear as it was taken, it is necessary to make a positive print. This is done by placing specially sensitized paper on the face side of the negative and permitting it to be exposed to the light for a short time. Light passes through the negative and affects the paper most where the negative shadows are least dark, turning the coating on the paper black or sepia or blue, depending on the kind of coating used.

The paper is then placed in a solution of hyposulphite of soda, which fixes the print permanently in the same manner as



DEVELOPING BECOMES A HOBBY

There is real fascination in following through pictures from pose to finished print. At the left is a compact type of amateur enlarger; it can "blow up" small films. Above, in the darkroom.

photographs for printed illustrations, high-speed cameras can now analyze action too fast for the human eye. Polarized light is used to overcome glare and to alter light and shade in making negatives, and infrared light is employed to increase photographic visibility in fog and haze. A Polaroid camera, which develops and prints the photo in seconds after the picture is snapped, is in wide use. News photographs are quickly transmitted long distances by wire, radio, and the photoelectric cell.

For additional information, consult the following articles:

Camera	Photoelectric Cell
Daguerreotype	Photo-Engraving
Light	Photogravure
Lithography	Polarization of Light

PHOTOGRAVURE, *fo toh gra vure'*.

Many of the numerous pictures of world events and places that you see in books and magazines are produced by the process of photogravure, which combines photography and etching. In making such an etching for printing, a positive photograph is first made on glass or film. This is placed in a reverse position against a copper plate which has been covered with a special bituminous varnish. The plate and photograph are exposed to light, and the portions of the varnish acted upon by light become insoluble.

the negative. The last process is to wash the print thoroughly (about one hour in running water) and then dry it, finishing the picture. Various effects can be obtained in developing and printing by diffusing the light, permitting some parts of the negative to be slightly overexposed or to be underexposed.

At first, color photography required three exposures and three plates, each sensitive to one of the primary colors. Today, color pictures can be taken on a single color film and can be developed and printed at moderate cost.

Development of Photography. The history of photography goes back to 1809, when Thomas Wedgwood made crude profiles. It has advanced through the daguerreotype, perfected by Daguerre in 1839, to the present day with the development of finer lenses, better films, and other improvements. In connection with making

The unaffected varnish is washed from the plate and the plate is etched (see **ETCHING**). After this process the plate is "retouched," that is, improved, by the graver. Pictures resulting from photogravure plates rival the best of steel engraving in detail and finish, and show no perceptible grain or screen. See **ENGRAVING**; **PHOTOGRAPHY**.

Keeping Fit



PHYSICAL, *fiz'i kal*, EDUCATION.

Throughout the United States and many other countries, considerable emphasis is being placed on physical education, designed to make men and women physically fit, sound in body and mind, and prepared to do the work of the world. Almost everywhere, schools have been or are being equipped with gymnasiums, playgrounds, athletic fields, and swimming pools. Parks and recreation facilities are more in demand in cities and towns than ever before. Grade schools, high schools, and colleges require courses in physical education and hygiene.

Such emphasis on the physical well-being of people came about neither accidentally nor through purely altruistic endeavors. It was the result of World War I—a war that revealed that one-third of the men in the major countries of the world were physically unfit. This shocking revelation was particularly true of the United States.

But it cannot be said that physical edu-

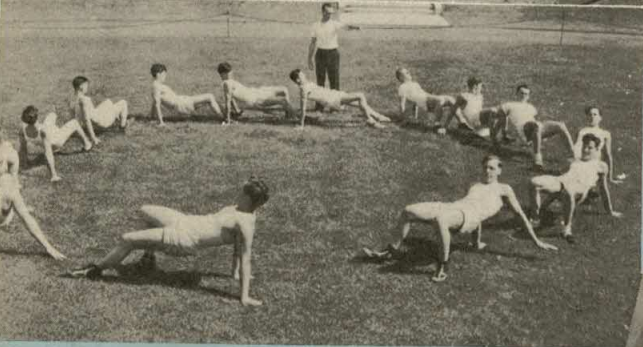
cation is being practiced merely to build more and better soldiers. Men have come to realize that healthy citizens make a healthy nation. They have come to see that a man trained in body and mind is a well-balanced man, able to enjoy life, capable of attaining an education unhampered by a sickly constitution, weak eyes, defective hearing, bad teeth, or a frail body. They have come to realize that the Greek formula of "a sound mind in a sound body" makes for advancement of civilization and a progressive, strong people.

Scope of Physical Education. Whether in grade school, high school, or university, the scope of physical education follows the same general pattern. It consists of medical inspection, instruction in hygiene, systematic exercise, and directed play. In many states the physical examination or health inspection of all children is required annually. Most colleges also require such an examination for entering students, including measurements of height and weight and tests of ears, eyes, heart, lungs, and general muscular and organic conditions. These examinations bring to light such defects as the student may possess, enabling his parents or himself to have them corrected. Some school systems provide vaccination service, furnish glasses, or conduct corrective exercise classes.

Not only is a medical examination a means of detecting physical faults in order that they may be corrected, but it is also a means of determining whether there are any physical handicaps to prevent a pupil or student from keeping up with his class.

The second part of the ordinary physical-education program is closely related to the first. It is the informational or instructional part, commonly called the teaching of hygiene. Through such teaching, students are taught the muscles and organs of the body, how they work, what is necessary to keep them functioning properly, and how to live to keep healthy and normal.

The third part of a typical physical-education program has to do with muscular exercise. Classes are usually provided in



Chicago Public School Photos

BUILDING HEALTHY BODIES

Top left, high-school hurdlers in a close race. Top right, a girls' gym class does calisthenics. Above, a brisk workout under the hot sun. Right, school boys swarm up the ladders in a gymnasium. Below, these determined young skaters will cheerfully risk a few bruises for the fun of racing.



schools whereby all students are taught to use their muscles properly. Handicapped students are given corrective exercises, and lessons are available in most schools in the various healthful and organized sports.

Keeping Fit. For any person seeking to keep fit, there are simple rules that should be followed. Under the article **HEALTH** in these volumes will be found the fundamental principles to be followed. A person should exercise frequently and regularly but should never wear himself out. It is necessary also to forego exercises that are harmful, for bad exercise is worse than none at all. A balanced diet also is necessary in keeping fit.

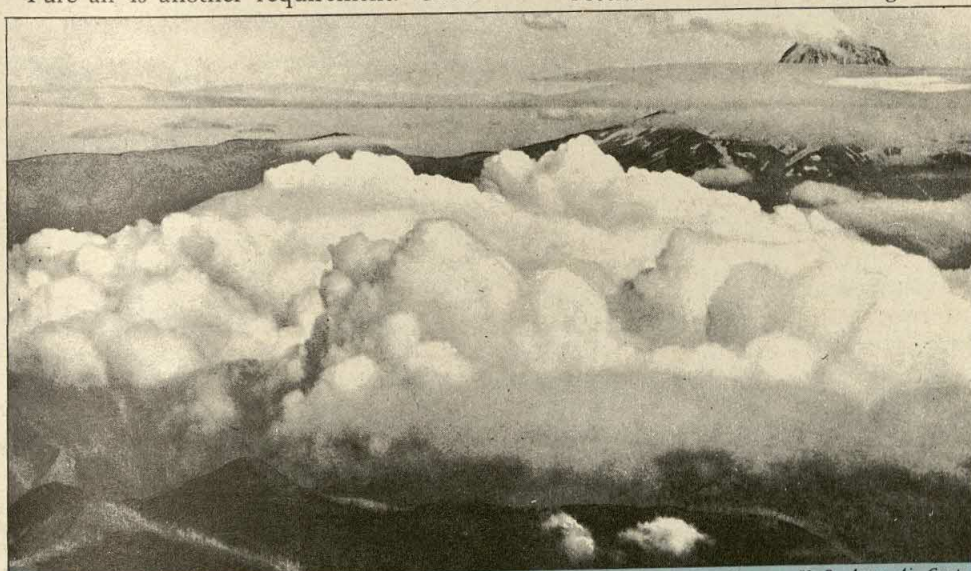
Pure air is another requirement. Good

ventilation in the room where one is asleep, at work, or in school is necessary. A room should seldom have a temperature of more than 70° F.

Good habits are also an important factor. Perhaps the best rule to remember is the Greek maxim of "everything in moderation," which, when all is said and done, was the basis of the entire civilization of Athens and, more specifically, the physical perfection that the Greeks achieved.

For additional information, consult the following articles:

Athletics	Gymnasium
Baseball	Nutrition
Basket Ball	Swimming
Diet	Tennis
Football	Wrestling



Courtesy U. S. Army Air Corps

This World of Ours

PHYSICAL GEOGRAPHY, or PHYSIOGRAPHY. What causes thunderstorms? What are the sources of artesian wells? Why does the wind change direction? The answers to these and many other interesting questions are found in the study of physical geography, or physiography. This science describes the various kinds of plains, plateaus, and mountains, and their minor hills and valleys among which we

live. It endeavors to show how they have been made, and to explain the processes of tearing down and building up which are continually at work changing the landscape which is so familiar and seemingly so permanent. Physiography is a part of geology: the latest, the unfinished chapter, in the history of the earth. It is equally as important as geography, for the distribution of agricultural crops and other



SCIENCE STUDY BEGINS AT HOME

A knowledge of the marvels of our own planet helps us to learn more about the universe.

products of human industry is profoundly influenced by the physical features of the earth, its climates, and its natural resources.

The subject matter of physiography discusses the physical aspects of the earth under three principal headings: (1) the *atmosphere*, which is the air, or the gaseous part of the earth; (2) the *hydrosphere*, the water, or liquid, part of the earth; and (3) the *lithosphere*, which is the earth's solid exterior. It also shows the interrelationships of the three.

The Atmosphere. Of interest to everyone are the characteristics of climate and the reasons for changes of weather (see METEOROLOGY). Physical geography treats of these phenomena. It also examines the composition of the atmosphere, and its depth and weight; how the sun's heat gets into the air and how it influences daily temperatures and the passing of the seasons. How the sun's heat causes winds by setting masses of air in motion, how moisture is held in the air, and how changes of temper-

ature may expel it under different conditions to form dew, rain, frost, or snow are allied subjects.

This part of physiography explains the nature of various winds, from tornadoes to the more important gentle storms of great size which drift slowly across the country. These gentle storms bring alternate periods of clear, dry weather and cloudy or rainy weather; they are the basis of the daily weather predictions furnished by the government weather bureau.

The Hydrosphere. The aspect of physiography which deals with the liquid portion of the earth is concerned mainly with the oceans. It includes accounts of the depth, volume, composition, temperature, and movements of these great bodies of water. The oceans are of special interest to persons engaged in foreign trade or the shipping or fishing industries.

The Lithosphere. Some of the important facts which physiography teaches about the solid earth have to do with its composition. First, we must know the basic substances of which the rocks of the earth are made; then we may understand how, by the various processes of weathering, the firmly adhering particles of these rocks crumble down or are dissolved, leaving an earthy material which is the basis of all soils.

A careful study of the hills and valleys teaches us that they are not permanent. Rather, they are in a process of slow, but continuous, change. These changes result from the work of various forces, some of which are continually raising the level of the land above the sea, while others work just as continuously at tearing it down. A large part of the study of physiography is devoted to the examination of these various forces and the exact means by which they do their ceaseless and resistless work.

In these volumes numerous phases of physical geography are treated separately under their own titles. See, for example:

Atmosphere	Geology
Climate	Ocean
Earth	Rain
Erosion	Weather Bureau
Geography	Wind



The Science of Matter and Energy

PHYSICISTS STUDY THE HOW AND WHY OF NATURE

Northern States Power Company

PHYSICS, *fiz'iks*. Such familiar conveniences as alarm clocks, automobiles, and radio sets are the results of centuries of research in physics, the science of matter and energy. No science is more closely related to our daily lives; it guides us in using the forces of nature and in understanding the things which affect our bodily senses. The science is divided into several main divisions—mechanics, heat, light, sound, electricity and magnetism, atomic physics, and radiation, the study of various waves and rays. Under each, there are many important subdivisions.

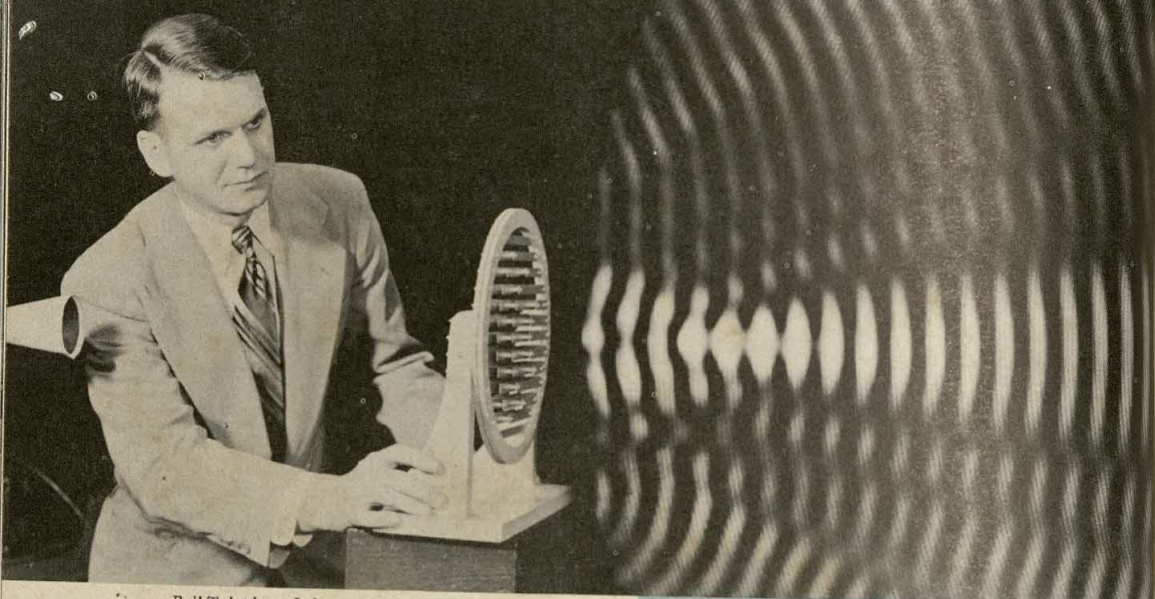
The Scope of Mechanics. That part of physics which we call mechanics deals with motion of all sorts, with the forces which produce motion, and with the machines which apply the forces. It deals with levers and pulleys, with airplanes and gyroscopes. When a stone falls to the ground, when a bullet is fired from a gun, when a spring vibrates, when anything moves in the world around us, it obeys definite mechanical principles. Mechanics deals, too, with the actions of fluids, both liquids and gases.

Learning About Heat. The study of heat is a subject of much more importance

than is ordinarily realized. Heat is the producer of power in the steam engine and the gas engine. It is the source of bodily comfort to all people; in fact, without heat we could not exist. Food value is measured in units of heat, and food is cooked with heat. When, in considering health and happiness, we remember the narrow range of temperature in which we are comfortable, really between 65° and 75° F., it is evident that we should know as much as possible of its properties.

The mechanical theory of heat, or *thermodynamics*, forms a branch of science that has been applied in power development to perfect the transformation of heat into power.

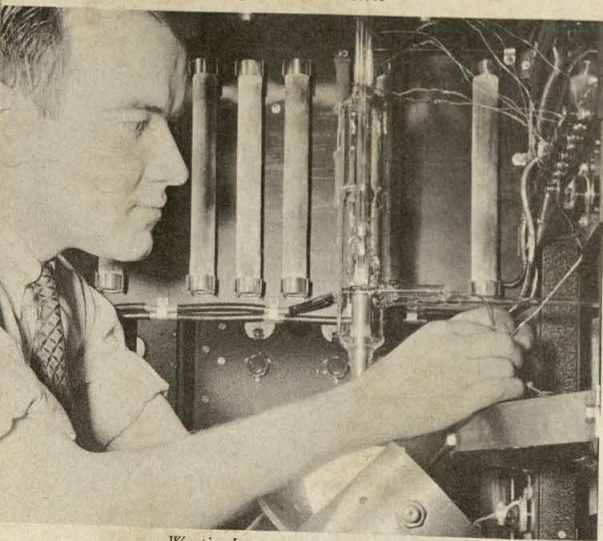
The Importance of Light. Light is the only visible thing. We do not see an object; we sense the light which comes from it. We are, therefore, dependent upon light for most of our knowledge of the world and what goes on in it, and the subject of the physics of light has importance both for the ordinary individual who works and plays with the aid of light, and for the scientist who wants to solve the secrets of the universe.



Bell Telephone Laboratories

EYES FOR THE EARS

Physicists can focus and photograph sound patterns (above). This is especially useful for studying the sound wave field of telephones and other communications equipment, and for studying microwave radio patterns.



Westinghouse

ATOMIC SPEEDWAY

In the mass spectrometer (left) atoms and molecules of gases are shot at speeds of a million miles an hour. An electromagnet sorts them by weight so their size can be measured by electrical meters.

“white” light is made up of light of all colors (see COLOR). By breaking up the light into its various parts, scientists have not only advanced the science of color and its use, but have also made wonderful discoveries about the very nature of the substances of which the world we live in is built.

The laws of light which apply in optics, projection, and illumination are definite and exact. Artificial illumination has today attained a high state of development. The art of lighting buildings, cities, and landscapes has the importance of a profession—that of the skilled illumination engineer, who puts into practical application the distribution of light in quantity, in quality, or in intensity, as the case may require.

We have all seen rainbows of light on a wall, caused by the presence in a room of a triangular piece of glass or the beveled edge of a mirror. These, and the rainbows out of doors, are proofs of the fact that

The Theory of Sound. The physics of sound, like the other branches of physics, has innumerable applications in our everyday life. It tells us that in air, sound travels in waves at the rate of nearly 1,100 feet per second, and that these waves are always produced by some vibrating object and can be reflected (as in the echo) just as light is reflected by a mirror. The study of sound gives us a scientific basis for music, and the making of musical instru-

ments, and it has had an important part in the invention of the telephone and the phonograph.

The Marvels of Electricity. No department of physics is more fascinating than this, whether to the scientist or to the boy who likes to experiment.

Electricity in motion produces magnetism; so electricity and magnetism are always studied together. Though at first the energy of electricity and magnetism may seem mysterious, actually its behavior is very well understood and the scientist can use it to perform many miracles. Any boy can learn to make a simple radio set.

From a practical standpoint the study of electricity and magnetism gives an understanding of the generator, the magneto, and the battery, by which electricity is produced; of the motor, by which its power is made useful at home, on the farm, and in factories; of electric lights and electric stoves. And from it we also learn of the operation of the telegraph and the telephone, and of radio with its innumerable applications.

Unity of the Physical World. These different fields of physics are only different manifestations of an underlying unity in nature. The forces which hold bodies together are very largely forces of electrical attraction. Heat is due to the energy of the atoms and molecules, moving about, bumping and flying apart like so many minute billiard balls. Light is an electromagnetic wave like radio but with very much shorter wave lengths.

Atomic Physics. Scientists found the basis for this underlying unity when they discovered the world of the atom. Toward the close of the nineteenth century, several remarkable discoveries were made that have altered older conceptions of the nature of matter. Between 1870 and 1880, the English scientist, Sir William Crookes, had demonstrated the remarkable rays emitted from the cathode of vacuum tubes. While experimenting with Crookes tubes, William Roentgen discovered X-rays in 1895, and the following year, radioactivity was

discovered by the French scientist, Professor Becquerel. The fact that the radiations he discovered represent the breaking down of the atoms of radioactive elements was made known by Rutherford and Soddy. Radium was discovered in 1898 by Madame and Professor Curie. These investigations, and others, have opened a new field of discovery and brought to light the close relationship between physics and chemistry. (See ATOM SPLITTING.)

It is now known that the cathode rays generated in Crookes tubes are streams of electrons, and that electrons are negatively electrified particles found in atoms. Positive particles, or protons, are found in the nuclei of atoms, together with neutrons.

Radium, a typical radioactive substance, gives off three types of rays—called *alpha*, *beta*, and *gamma*. Alpha rays are atoms of helium gas minus their electrons, and have a maximum velocity of about 12,000 miles per second. Beta rays are electrons having a terrific velocity which in some cases approaches that of light. Gamma rays are of the same nature as X-rays and light rays, but they are more penetrating.

It has been further shown that there is a vast scale of electromagnetic radiations, of which visible light forms one so-called octave. Electromagnetic radiation is propagated in the form of waves. The shortest waves known are the gamma rays of radioactive minerals; then, in order of length, are X-rays, ultra-violet rays, visible-light rays, infra-red, or heat, rays, and radio waves. Cosmic rays, which are of terrific penetrating power, are thought by some scientists to be caused by charged particles originating outside the earth's atmosphere.

The newer physics has also produced the quantum theory, namely, that radiation is a discontinuous process, and that energy is emitted in units called *quanta*. Also in the newer physics are Albert Einstein's special and general theories of relativity.

Many phases of physics and its practical applications are treated in separate articles throughout these volumes. For information on them, consult the following titles:

Acoustics
Atom
Atom Splitting
Boiling Point
Boyle's Law
Calorie
Cam
Capillarity
Center of Gravity
Centrifugal Force
Centripetal Force
Chemistry
Cohesion
Composition of Forces
Compressed Air
Cosmic Rays
Crookes Tubes
Density
Diffusion
Ductility
Dynamics
Dynamo
Eccentric
Echo
Elasticity
Electricity
Electric Motor
Electro-Chemistry
Electromagnetic
Theory of Light
Electromagnetism
Electronics
Energy
Evaporation
Expansion
Falling Bodies
Field Glass
Fluid
Foot Pound
Force
Freezing
Friction
Fuse
Gearing
Gravitation
Gravity, Specific
Gyroscope
Heat
Horse Power
Hydraulics
Hydrostatics
Ice
Inclined Plane
Induction Coil

Inertia
Insulator
Kilowatt
Lens
Lever
Light
Liquid
Liquid Air
Magnetism
Malleability
Matter
Mechanical Powers
Mechanics
Melting Point
Microscope
Mirror
Molecule
Momentum
Ohm
Pendulum
Perpetual Motion
Pneumatics
Polarization of Light
Power
Pulley
Radar
Radio
Radioactivity
Radium
Refraction
Roentgen Rays
Screw
Siphon
Sound
Spectrum Analysis
Spring
Steam
Strength of Material
Telephone
Telescope
Television
Temperature
Tenacity
Thermometer
Uranium
Vacuum
Vapor
Velocity
Volt
Water Power
Watt
Wedge
Weight
Wheel and Axle

BIOGRAPHY

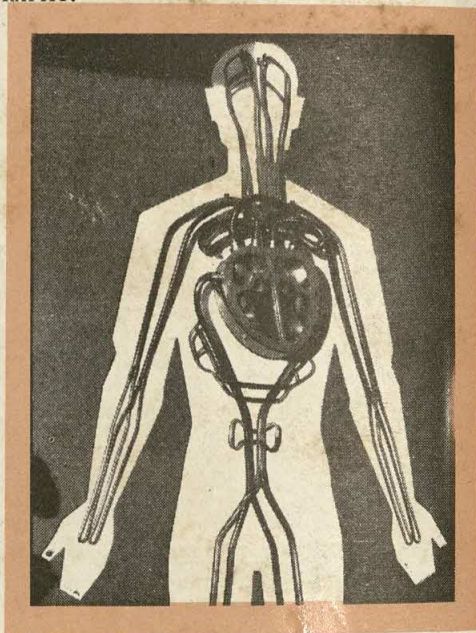
Archimedes
Bacon, Roger
Curie, Pierre and
Marie
Edison, Thomas A.

Einstein, Albert
Fahrenheit, Gabriel D.
Faraday, Michael
Gay-Lussac, J. L.
Galileo

Helmholtz, Hermann
von
Morse, Samuel F. B.
Watt, James

Newton, Isaac, Sir
Tesla, Nikola
Torricelli, Evangelista

PHYSIOGRAPHY. See **PHYSICAL GEOGRAPHY.**



CHARTING THE LIFE STREAM

This model demonstrating circulation of the blood is from the Buffalo Museum of Science.

PHYSIOLOGY, *fiz i ol'oji*. Every intelligent person ought to have a knowledge of physiology, the science which deals with the functions and interrelations of the various parts of his body, and which treats of the influences, good and bad, that affect it in the course of everyday living. Then he will have a basis for understanding the value of correct habits and hygienic care, to the end that this most marvelous of all machines may be kept in perfect order.

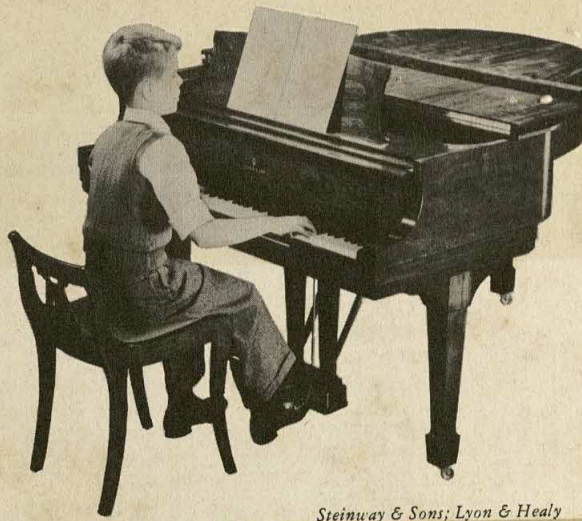
Physiology is the branch of biology that treats of the phenomena of living organs, as distinct from *anatomy*, which deals chiefly with their structure. The study of the living animal starts with the egg, which, having been fertilized, begins its growth with the division of its nucleus and the formation of two cells. By a continuation of this process of cell multiplication,

multitudes of cells are formed, which soon take up definite positions in three principal layers, each one of which is the origin of certain definite groups of structures in the finished organism. The body is composed of tissues, or fabrics, arranged in definite manner, each tissue having its own function to perform. By combinations of tissues, the various organs of the body are formed.

Additional information, directly related to the subject of physiology, may be found under the following titles:

Absorption	Lungs
Alimentary Canal	Lymph
Anatomy	Lymphatics
Arteries	Membranes
Blood	Muscle
Bone	Nails
Brain	Nerves
Breathing	Nervous System
Cartilage	Nose
Cell	Nutrition
Circulation	Oesophagus
Connective Tissue	Palate
Diaphragm	Pancreas
Digestion	Reflex Action
Ear	Ribs
Eye	Saliva
Face	Secretion
Fat	Senses
Fatigue	Skeleton
Food	Skin, The
Foot	Sleep
Gall Bladder	Smell
Gastric Juice	Spinal Cord
Glands	Stomach
Hair	Taste
Hand	Teeth
Health	Temperature of
Heart	the Body
Intestine	Tendons
Joints	Tissues
Kidneys	Tongue
Lachrymal Glands	Tonsils, The
Larynx	Touch
Ligament	Trachea
Liver	Veins

PIAN'O, or PIAN'OFORTE. Of all the many and varied musical instruments in the world, none is more popular than the piano. The instrument lends itself to the expression of all moods. It is the instrument used by composers for writing music, and more music has been written especially for it than for any other instrument.



Steinway & Sons; Lyon & Healy

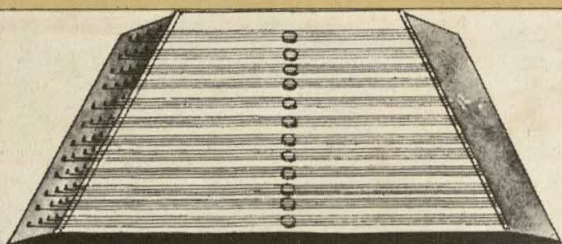
PRACTICE BRINGS PLEASURE

Years of pleasure and satisfaction will reward this young pianist for his efforts.

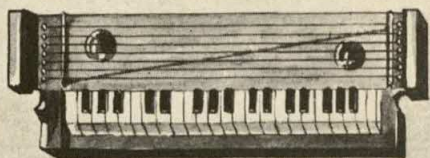
The pianoforte is descended from a line of percussion instruments, and derives its name from two Italian words: *piano*, meaning *soft*, and *forte*, meaning *loud*. It differs from the clavichord and harpsichord which preceded it, for it possesses means for modulating the tone.

To play a piano, keys are struck by the fingers of the player. This action operates a system of levers connected with felt-covered hammers which strike the strings stretched over a bridge and a thin sounding board, causing them to vibrate. The pedals, worked by the feet, may be used to deaden the sound or sustain it. Because the system of levers between the keys and the hammers is so delicate, the quality of sound can be altered easily by the pressure of the fingers. In playing, much practice is required to gain the technique necessary to attain whatever quality of tone is desired, through the fingers.

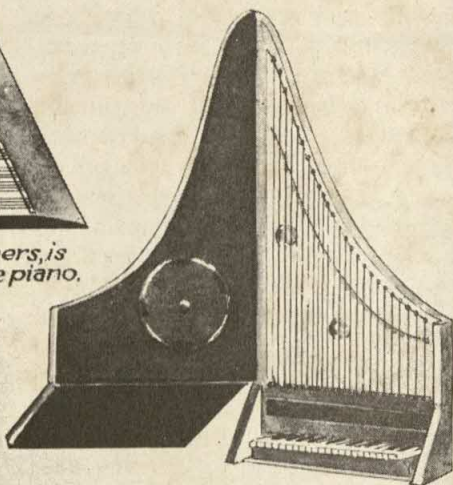
Pianos, in general, are of two types, the upright and the grand. Grand pianos vary in size from the full concert grand, nearly nine feet in length, to a "baby" grand, which takes up very little space. The upright style differs from the grand in that the strings and sounding board are stretched vertically instead of horizontally. It is popular because it takes little room, but it does not possess the musical qualities of the grand piano.



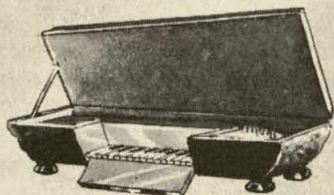
The Dulcimer, played with two hammers, is said to have suggested the idea of the piano.



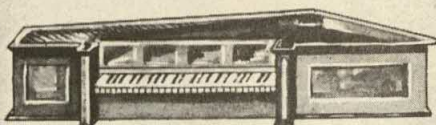
The Clavichord, one of the oldest keyed string instruments. On striking the key brass pins pressed upwards against the strings.



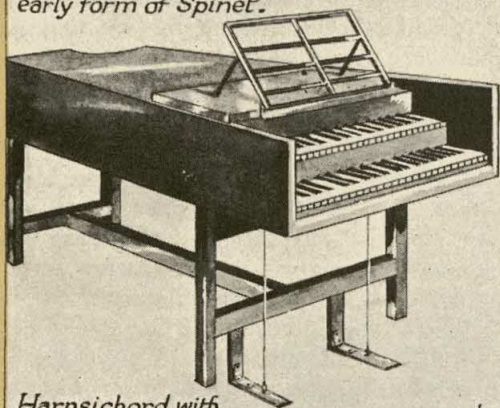
Clavicytherium, about 1510. The fingers struck a lever called a jack. This had a leather spine on it which plucked the string, making it vibrate.



The Virginal, about 1560, was an early form of Spinet.



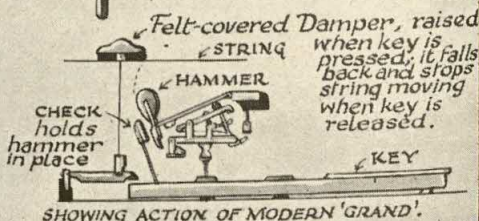
The Spinet, so called because of the spines or quills which plucked the strings. In use until 1760.



Harpsichord with two keyboards, 1770. The sound in this was also made by plucking, and not hitting, the strings.



An early form of Pianoforte. The strings are hit by hammers.



EVOLUTION OF THE PIANOFORTE

These stringed instruments all made a contribution to the development of the modern piano, in which the strings are vibrated by being struck with hammers and the tone can accurately be diminished or increased. The modern piano is a marvel of construction, containing some 4,000 carefully fashioned parts. The frame, particularly, must be very strongly constructed, for when the instrument is tuned and all the wires are taut, the case is under a strain of over twenty tons.

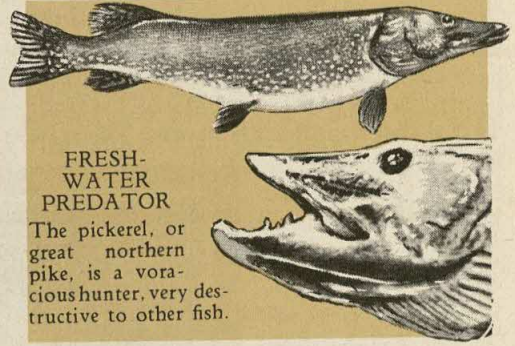
The first piano is thought to have been invented in 1709 by an Italian named Bartolommeo Cristofori. His instrument, however, had no pedals. In 1783 these came into being with a piano made by Broadwood in England; and the first upright piano was invented in 1800 by John Isaac Hawkins, an Englishman who lived in Philadelphia.

Automatic pianos, called player pianos, were popular before the era of the radio. In these pianos, the keys are operated by air pressure produced by a bellows manipulated by two pedals. A row of tiny openings, one for each note, draws the air to move the keys, the combination of notes being determined by a perforated roll. These instruments have been improved, and it is possible today to purchase an electrically operated player piano which gives a true reproduction of the original performance. Among the great pianists are Chopin, Liszt, Rubinstein, Paderewski, Horowitz, Rachmaninoff, Bauer, Hofmann, and Schnabel.

PIAS'TER, or PIASTRE. In Cyprus, Egypt, French Indo-China, Syria, and Turkey, one of the coins of the country is the piaster. It is a coin of small value, varying in the different countries, and is made of nickel, bronze or silver. The peso of Mexico and Spain is sometimes called the piaster. The lira, or Turkish pound, of 100 piasters is the monetary unit of Turkey.

PICCOLO, pik'ō lo. The small flute used in orchestras, the piccolo, is about one half the length of the usual flute. Its notes are an octave higher than those of the ordinary flute, and far above those of the human voice. For this reason it is possible for composers to get many weird effects with it. Beethoven in his *Pastoral Symphony* uses rising notes on the piccolo to imitate the shrieking of the wind. Other writers employ the piccolo in pastoral scenes to imitate bird songs. See **FLUTE**.

PICK'EREL. Found in the fresh waters of Eastern North America, the pickerel is a common game fish of the pike family. Pickerel make no nests for their young. Instead, the parent fish scatter the eggs among



FRESH-
WATER
PREDATOR

The pickerel, or great northern pike, is a voracious hunter, very destructive to other fish.

the weeds in shallow water. A two-pound fish will lay about 30,000 eggs, which hatch in about fourteen days. These are laid between March and May, the exact time depending upon the temperature of the water.

Pickerel east of the Appalachians were supposed to be different from those west of these mountains. They are now believed to be the same. Pickerel differ from pike in that the sides of the head from top to bottom are covered with scales. See **PIKE**.

PICK'ETT, GEORGE EDWARD (1825-1875). A distinguished American military leader, George Edward Pickett, born in Richmond, Va., was one of the bulwarks of the Confederate army during the Civil War. Graduated from West Point, Pickett served in the Mexican War and on the Western frontier, but resigned his commission at the outbreak of the war to join the Southern cause. He fought valorously in the Peninsular Campaign and later was made a major general. Pickett saw service at the Battle of Fredericksburg, Va., and led the famous charge at Cemetery Ridge in the Battle of Gettysburg. After the war, the general retired to business life in Richmond. See **GETTYSBURG, BATTLE OF**.

PICKLES, pik' 'lz. Although not extremely important as an item of food, the various forms of pickles are popular because they whet the appetite and add spiciness to the principal meat and fish dishes. They consist of fruits and vegetables preserved in vinegar, to which sugar and spices may be added. Certain vegetables, particularly cucumbers, are first permitted to stand

for some hours in a strong brine, and are then cooked in the vinegar preparation. Cucumber pickles are of four types, sweet, sour, dill, and kosher, each of which is made by a distinctly different process. There are several kinds of mixed pickles, such as piccalilli, mustard pickles, and chow-chow.

PICTS. The inhabitants of Northern Britain and Ireland before the arrival of the Celts were the Picts. It is known that the Irish Picts established an organized kingdom, but except for this fact, the origin and life of these people remain a mystery. The Gaelic civilization, spreading from Ireland to Scotland, put an end to Pictish society about the fifth century.

PIEDMONT, *peed'mont*, **REGION.** Lying between the low Atlan-

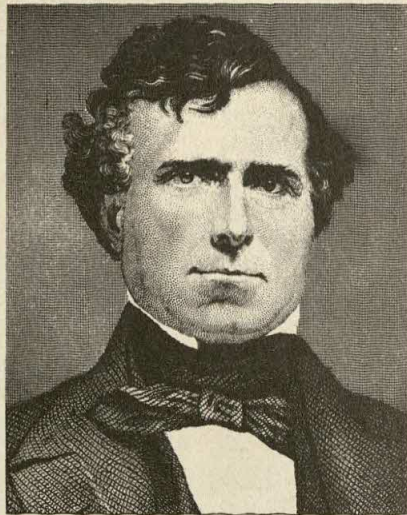
tic coastal plain and the Appalachian Mountains in Eastern United States is a high, rugged plateau known as the Piedmont region, the name meaning *foot of the mountain*. A sharp escarpment marks the line where the Piedmont drops to the coastal plain, and forms what is known as the Fall Line. Most of the eastward-flowing rivers of the United States cross the Fall Line in rapids or cataracts, thus providing great potential water power. Early manufacturing cities were built on the Fall Line to take advantage of the water power, but hydroelectric power is now generated at the falls and distributed over wide areas. The Piedmont region begins in New England as a very narrow

strip, but it becomes wider toward the south, and in North Carolina it is more than 300 miles across.

PIERCE, FRANKLIN (1804-1869). Although an honest and capable man, Franklin Pierce, fourteenth President of the United States, did not leave an outstanding record of statesmanship during his administration (1853-1857). He was able to accomplish little to settle the dispute regarding slavery, which had been increasing in intensity ever since the Missouri Compromise of 1820. In the year before his election, Harriet Beecher Stowe's *Uncle Tom's Cabin* had appeared and had greatly accelerated the growth of antagonism between the abolitionists and the pro-slavery adherents.

Preparation for the Presidency.

Franklin Pierce was born at Hillsboro, N. H., on November 23, 1804. He was the son of a former Revolutionary War officer and politician. Young Pierce was educated at Bowdoin College, where he formed a cherished friendship with Nathaniel Hawthorne. After studying law for three years, he was admitted to the bar in 1827, the same year in which his father was elected governor of New Hampshire. As a Democrat, he entered politics in 1829, serving in the state legislature from 1829 to 1832, when he was sent to the national House of Representatives. At thirty-three years of age, the rising young politician became the youngest member of the United States Senate (1837). After resigning from the Senate, in 1842,



FRANKLIN PIERCE

Fourteenth President
Administration, 1853-1857

Pierce was in the White House at a time when the issues which led to the Civil War were dividing North and South. His vigorous foreign policy was designed to divert attention from internal strife.

Pierce practiced law and saw service in the Mexican War, attaining the rank of brigadier general of volunteers. For ten years prior to the election of 1852, he took little part in politics and did not align himself with any of the factions of the Democratic Party. For this reason he made a safe and neutral candidate for a party which pledged itself to uphold the Compromise of 1850. In the election of 1852, the Democratic candidate easily defeated General Winfield Scott, the Whig choice.

Pierce's Administration. Probably the most important event during the administration was the passage of the Kansas-Nebraska Bill (1854), which nullified the Compromise of 1850. It was the product of the arguments advanced by Senator Stephen A. Douglas of Illinois—that new territories should solve their slavery question themselves. This theory was popularly known as the “squatter-sovereignty” doctrine, and caused Kansas to become a battlefield for settlers from both the North and the South. The area came to be called “bleeding Kansas” and was the scene of John Brown's early anti-slavery exploits.

When Representative Preston S. Brooks of South Carolina attacked and seriously injured Charles Sumner, popular anti-slavery Senator from Massachusetts, Northern feeling was further intensified. Political parties split, and in 1856 the Republican party held its first convention.

President Pierce's foreign policy was directed by William L. Marcy, Secretary of State, and not much of lasting importance was achieved. Some politicians favored turning public attention away from slavery to a foreign issue, and advocated either the purchase or seizure of Cuba. Pierre Soulé, minister to Spain, was instructed to negotiate for the purchase, but Spain refused. The famous but ridiculous Ostend Manifesto was then issued by Soulé, Buchanan, and Mason, at Ostend, Belgium, in 1854. In brief, it stated that by purchase or by force Spain must relinquish Cuba to the United States. The administration denied responsibility for the document.

During Pierce's term a treaty was signed to adjust the Atlantic fishing rights with Canada (1854); the Mexican boundary question, aftermath of the Mexican War, was settled by the Gadsden Purchase (1853); William Walker organized his filibustering trip to Nicaragua (1853); and Commodore Perry succeeded in obtaining a trade treaty with Japan, opening that country's ports to commerce (1854).

At the end of his four years, Pierce was not renominated by his party, and he retired to private life, practicing law and traveling in Europe. He died in 1869 and was buried at Concord, N. H.

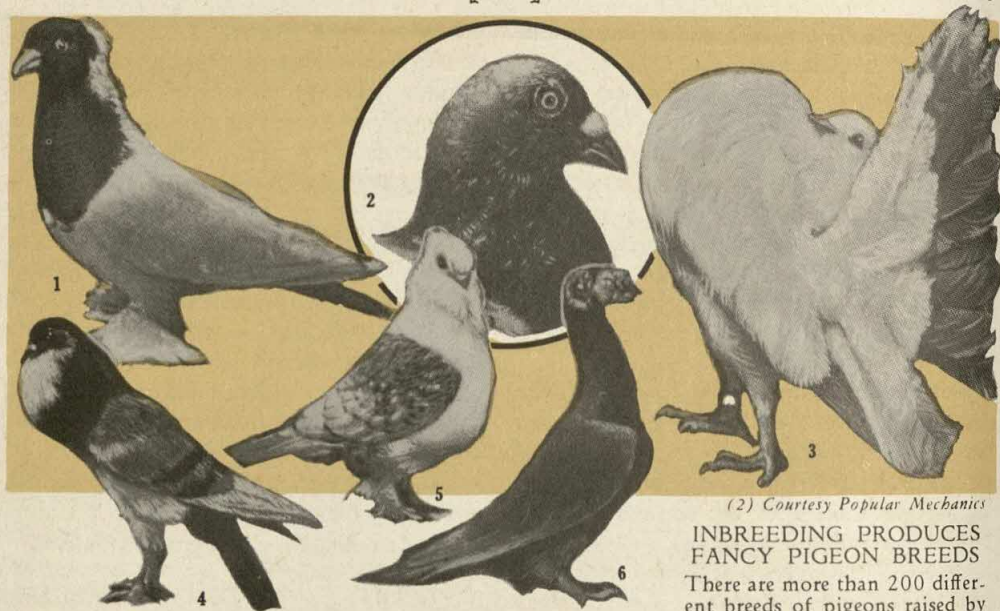
For further information, consult the following articles:

Gadsden Purchase	Perry, Matthew C.
Kansas-Nebraska Bill	Squatter Sovereignty

PIERRE, *peer*, S. D. On the east bank of the Missouri, near its junction with the Bad River, stands Pierre, the capital of South Dakota since 1890. The trading center and shipping point for a productive farming area, Pierre has about 5,700 residents. Its points of interest include the capitol, with its historical paintings, and the Soldiers' and Sailors' Memorial Hall, housing the State Historical Library and the State Museum. In the latter is a lead plate claiming the region for France. Buried by François Vérendrye, the explorer, in 1743, it was not discovered until 1913. Nearby are a Federal Indian school and the site of historic Fort Pierre, once a fur-trading post. Army campaigns against the warring Sioux Indians were planned there.

PIGEON, *pij'un*. Found in the temperate and tropical lands throughout the world, the pigeon is a bird of great antiquity. It is related to the gulls, auks, and sand grouse, and is believed to be a direct descendant of the blue rock dove.

Pigeons are of medium size and in most temperate regions have glossy, metallic coats of slate, gray, or brown. Those of the tropics, however, are brilliantly colored. Pigeons usually build their fragile nests in exposed places, and their eggs are often



(2) Courtesy Popular Mechanics

INBREEDING PRODUCES FANCY PIGEON BREEDS

There are more than 200 different breeds of pigeons raised by fanciers throughout the world.

They have been developed through centuries of selection: pigeon raising was an ancient occupation in Biblical times. (1) German toy type. (2) A Homer. (3) Fantail. (4) Pouter. (5) Satinette Oriental Frill hen. (6) The Carrier, king of all fancy pigeons.

destroyed by other birds and animals. The female lays but two eggs and is assisted in the hatching process by the male bird. The young pigeons, or squabs, are fed in part by softened food (pigeon's milk) from the mother's crop until they are old enough to fly in search of their own food. Squab raising is a profitable industry in many places, for young pigeons are considered a great delicacy as a food.

Among the most interesting pigeons is the *pouter*, which can swell its chest until its neck and head are almost hidden. Another group, called the *fantails*, consists of small, graceful, round-bodied birds with beautiful fan-shaped tails, prominent breasts, and swanlike heads. *Carrier* pigeons comprise another popular breed greatly favored by pigeon fanciers. The *Jacobins* wear a "feather collar" about their necks. The *tumblers* are so-called because they turn somersaults during flight.

The commonest North American pigeon, the *mourning dove*, is easily recognized by its plaintive *c-o-o-o*. In the early days of America, the *passenger* pigeon was found

in countless numbers throughout the eastern section of North America. A beautiful bird fully fifteen inches long, attractively plumed, and with graceful tail and wings, it is now extinct. See Dove.

PIKA. This interesting relative of the rabbit family resembles the domesticated guinea pig in size and form, but the prevailing color is more like that of the cottontail rabbit. The legs are very short, the feet white, and the ears broad, rounded, and edged with white. Pikas are found in Western North America, from Alaska southward along the high crests of the Rocky Mountains and the Coast Range. They make their homes in the crevices of rocky ledges and slides, chiefly above the timber line, but are sometimes found among the stunted timber near the upper limit of trees.

They are industrious, provident little fellows, and are active and alert, ever watchful for enemies, which they endeavor to escape by scurrying quickly into sheltering crevices. They store up grasslike plants for winter use.



THE DEPARTURE FROM LEIDEN

Determined to maintain the purity of their faith, the Pilgrims sail for a new world.

PIKE. Not only are pike larger than the related pickerel, but they are found over a greater area of the earth. They are freshwater fish. In Northern Europe and Asia, and in North America from Lake Champlain in New York to Northern Indiana, and northeast to Quebec and northwest to Alaska, these fish may be caught.

Pike prefer to live in the clean water of a sluggish current, where they lie in wait among plants for other fish, frogs, crawfish, large insects, and sometimes small ducks. Their food is captured by a lightning-like dash, and if it happens to be attached to a hook and line, the person at the other end of the line has a lively time for a while, for pike are excellent game fish.

PIKE, ZEBULON MONTGOMERY (1779-1813). Probably the most celebrated mountain in the American Rockies is Pike's Peak, named for Zebulon Montgomery Pike, who discovered it in 1806. Pike, an

officer in the United States Army, led several expeditions into the land west of the Mississippi River, and gained valuable information concerning the territory.

Pike was born in New Jersey. By 1800 he had become a lieutenant in the army. His first exploration trip took him up the Mississippi River to Cass Lake, which he believed was the river's source. Later, he journeyed to the headwaters of the South Platte and Arkansas rivers, and, on this trip, sighted the peak which bears his name. The explorer was killed in the War of 1812.

PILGRIMS. A band of dissenters, or Separatists, from the Church of England, who came to America on the *Mayflower*, became known in history as Pilgrims. This name was given them by William Bradford, their first governor, who referred to them as "pilgrims and strangers upon the earth." They were forced to leave England in 1608, and went to Holland. In 1620 a

group set out for England in the *Speedwell*, and this ship and the *Mayflower*, with another band of Separatists, started for America from Southampton. Because the *Speedwell* proved unseaworthy, the Pilgrims made the trip in the *Mayflower*, landing at Plymouth to found the first colony in New England. See MASSACHUSETTS; PLYMOUTH COLONY.

PIL'LORY. During the early colonial period and in England, fastening a person to the pillory in a public place was a common punishment for minor crimes, subjecting the criminal to ridicule and embarrassment. The length of time he was confined was determined by the nature of the crime. The pillory was constructed by mounting horizontally on a post two boards placed one above the other with their edges touching. At one end the boards were hinged together so that the upper one could be raised; at the other, a lock was provided. With the two boards fastened together, three circles were cut in them—one in the center to hold the victim's neck, and one on each side to lock his wrists securely.

PILOT FISH. Often seen in the company of the shark, the pilot fish received its name from ancient navigators who believed that it acted as a pilot for its vicious companion and for ships. The pilot fish is silver-gray in color, and its plump body is encircled by five blue-black bands. It grows to a length of one to two feet; its meat is said to resemble that of the mackerel, and its favorite haunts are tropical waters.

PIMA, pe'ma. Fine pottery and beautiful basketry testify to the industry and culture of the Pima Indians, a leading tribe of Southern Arizona. They are proficient farmers, having practiced irrigation of the arid soil for many years. The Pima are believed to have originated in the Salado River Valley of Arizona, and then to have spread to the Gila River Valley, where they built the celebrated Casa Grande pueblo.

When their land was overrun by enemy tribes, they gave up living in pueblos and constructed small, dome-shaped houses of brush, with roofs of earth and straw. They

number approximately 5,000. See PUEBLO.

PIMENTO, pi men'toh. Among the important commercial plants of the West Indies is the pimento, a tropical evergreen tree of the myrtle family. The berries of the tree are gathered, dried, and ground into the well-known allspice, a common article in every housewife's kitchen. The name pimento is also applied to a certain species of sweet pepper, used in stuffing olives and as a flavoring. See ALLSPICE.

PINCK'NEY, CHARLES COTESWORTH (1746-1825). "Millions for defense, but not one cent for tribute!" This ringing declaration of American independence and honor is said to have been the reply of Charles Cotesworth Pinckney to suggestions that he pay a bribe, when he went to Paris in 1797 on a commercial mission.

Pinckney was born in Charleston, S. C., and was educated in England and France. When the Revolutionary War broke out, he joined the colonial forces, and later rose to the rank of brigadier general. He was a delegate to the Constitutional Convention from South Carolina in 1787. Pinckney was appointed minister to France in 1796, but the French government refused to receive him. He was twice an unsuccessful candidate for President. See X Y Z CORRESPONDENCE.

PIN'DAR (522?-445 B. C.). The finest lyric poet of ancient Greece was Pindar, the scion of a noble Boeotian family. Unlike many artists, Pindar was recognized as great during his lifetime, and many of his works were written as commissions to honor important athletic and religious events. His chief works are hymns to the gods and lyrics to be intoned by choruses, and in many of them is shown the first faith in the immortality of the soul to be exhibited by any Greek. Pindar lived most of his life in Thebes, although he was well traveled.

PINE. Hardy and stately pine trees hold a high place in the forests of the world. Not only are they members of the aristocratic and ancient evergreen clan, but they furnish much of the lumber and timber by-products



U.S. Forest Service

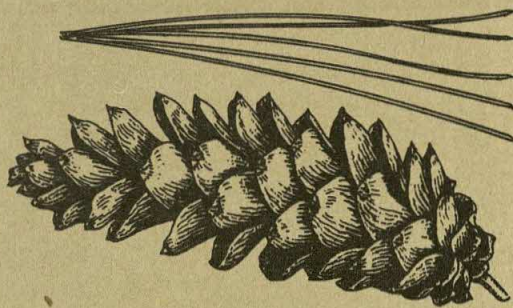
ONCE THE FOREST KING

Ruthless logging dethroned the eastern white pine as monarch of the eastern forests.

employed by the woodworking industries.

Of the eighty species of pines in the world, fully one half are in North America. All can be distinguished from other evergreens by their long, narrow, and needle-like leaves which, singly or in groups, are sheathed at their base. In North America, pines are found growing from the Atlantic to the Pacific coasts, from the Arctic Circle to the West Indies, in all sorts of soil, and under almost every climatic condition.

There has been considerable waste in cutting the pine forests, particularly in the exploitation of the *white* pine, which, for many years, was the leading lumber producer in the United States. This stately tree grows to a height of 75 to 150 feet and has a diameter of about four feet. Its wood is



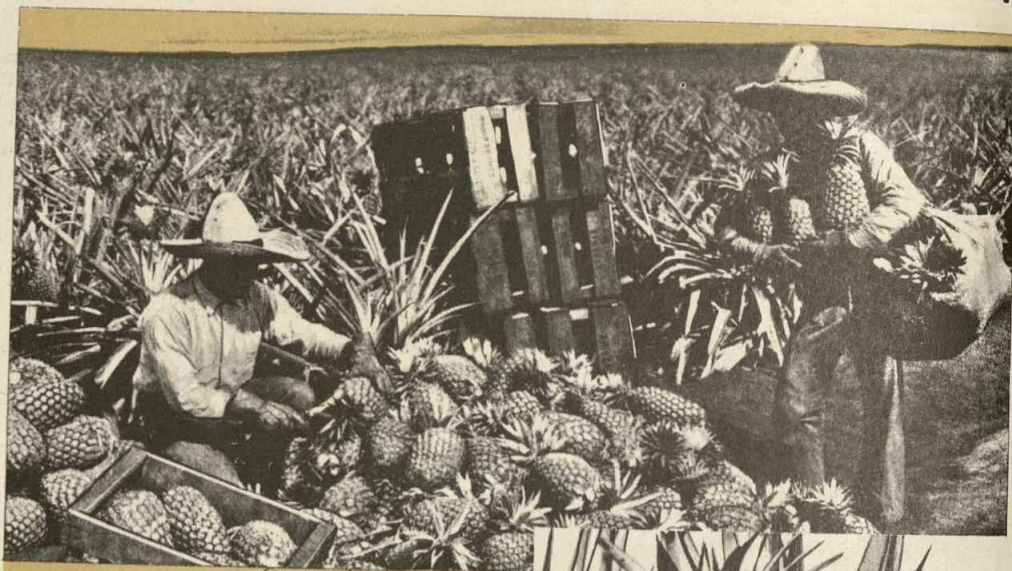
white, soft, and straight-grained. Today, the eastern white pine is less important than the western white pine and sugar pine.

With the decline of the *white pine*, *Southern pine*, also called *yellow*, or *long-leaf*, pine, has taken its place. Found in the South Atlantic and Gulf states, it is of considerable economic value. Not only is its yellow, hard, and fine-grained wood used for lumber, but it is also the source of pitch, tar, resin, and turpentine. From the Southern pine industry also come firewood, varnishes, medicines, and wood pulp for making many articles, including rayon and wallboard. A process for making newsprint from *slash-pine* pulp increased the importance of the South's pine forests.

A few of the other types of pine found in North America include the *mountain*, *sugar*, *white-bark*, *foxtail*, *nut*, *shortleaf*, *Cuban*, *loblolly*, *pitch*, *scrub*, and *red* pines. See CONIFERAE; FORESTS AND FORESTRY; LUMBER.

PINE APPLE. So-named because of its close resemblance to the pine cone, the pineapple is a justly popular fruit. The plant is a hardy perennial, native to South America and the West Indies. It was taken to Europe by the early Spanish explorers, and today is cultivated widely throughout the tropics.

The pineapple plant grows from two to four feet high. Around a stump, or short stem, grow the leaves—long, spiny structures, spirally arranged. The flower-bearing stalk rises from the center of the cluster.



Courtesy American Can Co.

THEY'RE BEST STEM-RIPENED

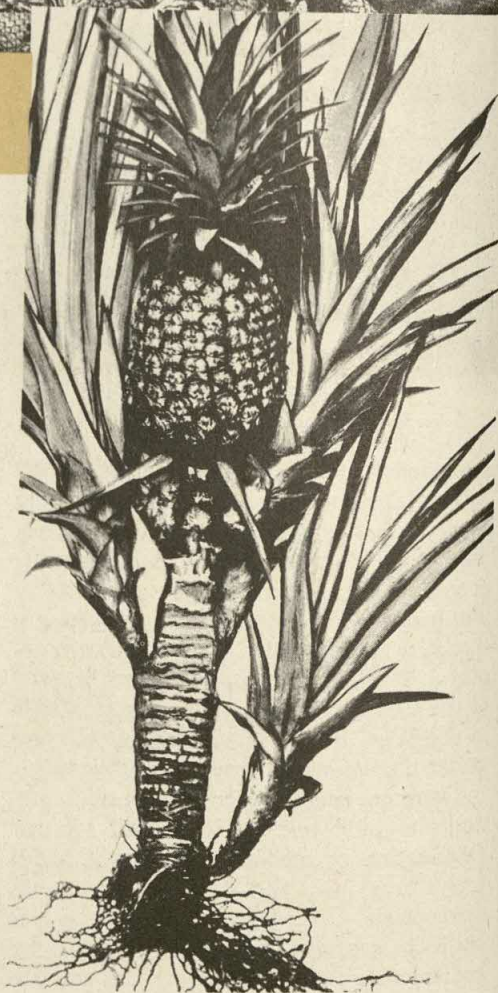
Expert pickers go through the fields testing the fruit to see if it has reached canning ripeness (above). Right, the plant.

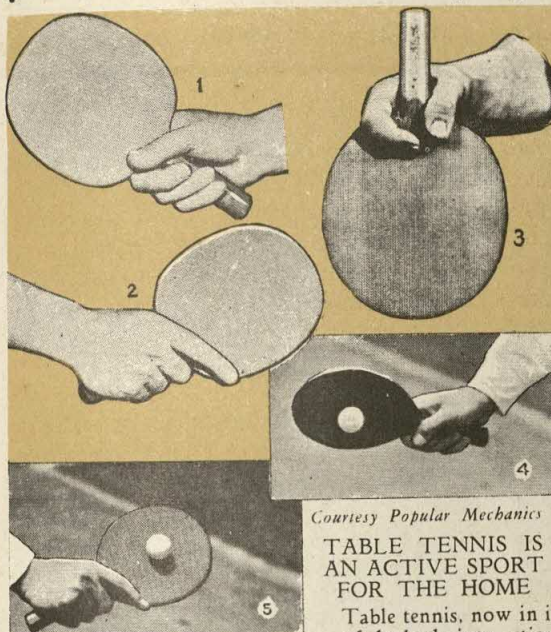
When the plant is about sixteen months old, purplish blossoms appear. Each flower is protected by a bract, and the pineapple fruit represents the union of the flowers and bracts into a fleshy mass. The fruits mature about four months after the blossoms appear.

The plant requires a moist and warm climate. While ripening, the "apple" absorbs sugar from the stump, and so the best fruit is not picked until fully matured. The fruit is covered with a hard, horny rind and is surmounted by a cluster of prickly leaves. Because of its protective covering, the fruit will withstand considerable rough handling and long storage.

Florida is the only state in the United States that attempts the cultivation of pineapples. Most of the canned pineapple in American markets is imported from Hawaii, although the West Indies are also a source of supply.

Pineapples may be eaten raw as they come from the field, or they may be canned and later used for desserts and salads and in cookery. The juice of the fruit is a popular drink and an important source of Vita-



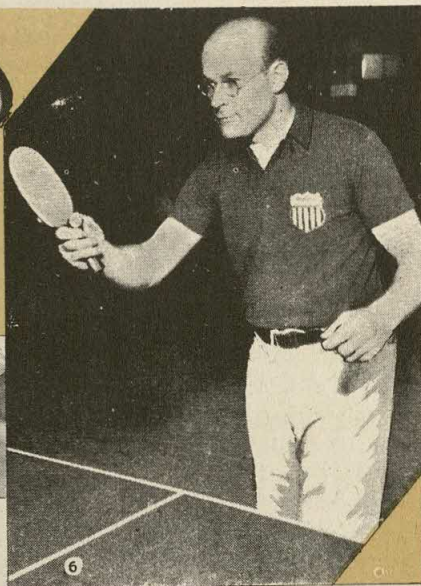


Courtesy Popular Mechanics

**TABLE TENNIS IS
AN ACTIVE SPORT
FOR THE HOME**

Table tennis, now in its third revival, calls virtually every muscle of the body into action when played by skilled competitors. The game is played in every civilized country and it is estimated that some two or three million Americans have taken it up. Front and back views of racquet grip are shown at (1) and (2).

(3) The "penholder" grip. (4) Forehand drive. (5) Backhand. (6) Forehand chop.



min C. In the Philippines, the fiber of pineapple leaves is woven on hand looms into a thin but rather stiff cloth.

PINE SNAKE. Also known as the *bull snake*, the pine snake is found in the southern half of the United States, usually in the pine regions along the Gulf of Mexico. It may reach a length of over seven feet. Although quite harmless, the pine snake will become quite noisy when disturbed, hissing loudly and sometimes emitting a bellying sound like that of a bull. The reptile, which has an offensive odor, feeds on birds, eggs, and small animals.

PINE-TREE MONEY. From 1652 to 1682, coins in shilling, sixpence, and three-pence denominations were used in Massachusetts. Because they bore the rude figure of a pine tree on one side, they were known as pine-tree money. On the other side of the coins was inscribed *New England* and the date.

PING PONG, or TABLE TENNIS. Popular everywhere is the indoor sport known as ping pong, or table tennis. It is played on a table five by nine feet, with a

net six inches high stretched across the table halfway between the ends. A small celluloid ball is hit with a small wooden paddle or racquet which is held in one hand. The points are made by the server whenever his opponent is unable to return the ball over the net. The servers alternate every five points. When one person obtains twenty-one points, he wins the game. Doubles also may be played, with two on a side.

PINK. A beautiful flower in any garden is the pink, a lovely little blossom with a fragrant scent. Its name comes from the fact that the petals have scalloped edges, rather than from the color, for the pink occurs in many hues. The flowers may be single or clustered, and the foliage is green and grasslike. There are about seventy species, including the *sweet william*, *pheasant's eye*, and *carnation*.

PIPE. Many types of tubing and conduit classified as pipe are in wide use for conveying gases and liquids. Lightweight pipes are made of galvanized sheet iron or copper for the conveyance of rain water from buildings. Water and gas under pressure

are conveyed by wrought-iron or steel pipe with threaded joints.

Where pipe is subject to corrosion, it is often galvanized, or covered with zinc alloy, to protect the iron. In some instances the pipe may be lined with lead when corrosive liquids are to be conducted. Copper and brass pipes are used where a special material is needed to resist corrosion. Lead pipe is used extensively in plumbing where permanent work is installed. Lead pipe is joined by soldered or wiped (hammered) joints. Cast-iron pipe is used more extensively for large water pipes and for sewer waste. Tile or vitrified-clay conduits are often spoken of as pipe.

PIPE/FISH. A long, slender denizen of the deep, the pipefish greatly resembles a blade of the eel grass in which it lives. From two and one-half to three feet in length, the fish is covered with bony plates and has a long snout which terminates in a small, grotesque mouth. The eggs of the pipefish are carried in a small sac on the underside of the male. The pipefish lives on small animals and fish eggs and often stands "on its head," grubbing with its snout in the muddy bottom. These fish are found in warm seas, but sometimes they inhabit fresh water.

PIPE LINES. Most important oil- and gas-producing areas, including the United States, Canada, the Near East, and Soviet Russia, have their pipe lines. Many of these carry crude oil from oilfields to refineries or to ports. Others transport oil products from refineries to markets, or natural gas from producing wells to users of this product.

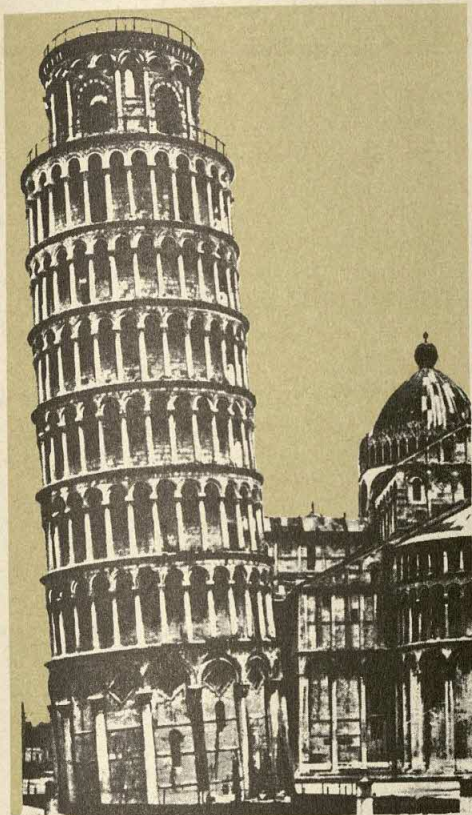
Some lines are only a few miles long; others traverse considerably more than a thousand miles, even crossing rivers and high mountains. Pipes, usually made of wrought iron or steel, measure from two to thirty or more inches in diameter. Some "cargoes" are moved by the force of gravity; others, by pumps located at intervals along the line. The United States has far more pipe-line mileage than any other country in the world.

PIP'IT, or TIT'LARK. A northern bird of fields, shores, and open country, the pipit is rarely, if ever, seen in trees. It has the peculiar habit of vigorously wagging its tail as it walks about on the ground in search of food. The bird is nearly seven inches long, and is brownish gray in color, usually more or less streaked with a darker shade above. It shows white outer tail feathers in flight. The pipit sings on the wing like the larks, having a soft, melodious song. It belongs to the wagtail family.

PIRACY, pi'ra si. Thrilling tales are told of pirates, lawless raiders of the sea, who attacked merchantmen, seized the cargo, and often forced the crew to "walk the plank." Probably the earliest pirates roamed the Mediterranean, preying on Phoenician and Roman commerce in ancient times. Later came the vikings of the Baltic; the Moslems and Venetians of the Mediterranean, and the raiders in the Far East.

Pirates differ from privateers in that they owe allegiance to no flag, but raid all ships indiscriminately. Piracy, in peacetime, is an offense punishable by death, but a pirate is usually entitled to a trial which may take place in any competent court. In 1803 the United States found it necessary to fight a war against the pirates of the Barbary States who were paralyzing American shipping in the Mediterranean. Today, piracy seldom occurs except in the remote waters of the Orient. See **BUCCANEERS**; **PRIVATEER**.

PISA, pe'sah, LEANING TOWER OF. Travelers in picturesque Italy almost invariably visit Pisa, where the celebrated leaning bell tower is located. Built of marble in the Romanesque style, this 179-foot structure leans sixteen feet out of the perpendicular. It is constructed in eight stories, each of which is encircled by outside arches. A spiral staircase ascends to the top. The tower was completed in 1350. Some authorities claim that the builders intentionally gave the tower its inclination; others say that the slant is accidental. It was from the top of the Leaning Tower that Galileo demonstrated that objects of different weights fall with the same velocity. See **GALILEO**.



WORLD-FAMED SLANT

The campanile of the Pisa cathedral is the much-visited Leaning Tower, begun when Pisa was a wealthy and important maritime power.

PISTACHIO, *pis ta' shi o*. The tree which bears pistachio nuts is of the cashew family. It is native to Asia Minor and the Holy Land. During the Middle Ages the Arabs in Sicily brought the cultivation of the pistachio to a high level, and toward the end of the last century the Sicilian industry was revived by grafting the true pistachio onto the wild turpentine trees which were plentiful on the island. It is from Sicily that our best nuts now come.

The pistachio is a dry-climate tree, and, though harder than the olive, will not stand as much cold. It often reaches a height of thirty feet. The grafted trees bear in their fourth year. In about eight years the annual yield of a tree is from 25 to 100 pounds of nuts. The nuts are tiny pale-green or yellowish kernels, which, if they are to be

eaten, are soaked in brine and sold while still in their thin shells. Nuts to be used for flavoring are shelled.

PISTOL. See REVOLVER.

PITCH. See TAR.



THE CUP THAT KILLS

This split digestive cup of a *Nepenthes* pitcher plant shows how victims are trapped.

PITCHER PLANT. Because it actually decoys, kills, and digests insects, the pitcher plant, found in northern bogs, is said to be carnivorous.

The pitcher part of the plant is botanically a hollowed, enlarged leaf petiole, usually half filled with water. The broad, expanded leaf blade at the top of the pitcher is equipped with purple lines, pointing downward into the throat of the pitcher. The pathway into the interior is beset with hairs pointing downward. Under the rim there is an area of secretion, holding a sweet juice, while below the hairs there is a smooth area. The insect, attracted perhaps by the purple lines, alights on the leaf blade and is guided downward either by the lines, the attraction of the sweet secretion, or by both features. The bristly, downward-

pointing hairs prevent the prospective victim from going back. The insect slides into the water, and after a desperate struggle is drowned. The body decomposes, and the plant is thought to utilize the products of decomposition for its own nutrition.

PITT, WILLIAM, First Earl of Chatham (1708-1778). England first rose to her place among the world powers under the older William Pitt, a statesman whose policies brought land and wealth to the growing empire.

Educated at Eton and Oxford, Pitt entered Parliament when he was twenty-seven years old, and immediately was recognized as a powerful opponent of Robert Walpole. In 1746 he became Vice-Treasurer of Ireland, and later that year, Paymaster-General. When he was raised to the post of Secretary of State, he took over the real power of the government as the leader of the House of Commons. It was while he served in this capacity that Clive was winning India for England and Wolfe was preparing for the war that would win Canada from the French.

Pitt lost power in 1761 after George III came to the throne, but he continued to dominate Parliament by his oratory and judicious policies. In 1766 he entered the House of Lords as Earl of Chatham and took the office of Lord Privy Seal. He urged conciliation with the American colonies, warning that serious trouble would ensue unless the drastic laws were modified. He attempted to form a ministry that year, but failed. Pitt lived to see the American colonists rebel, but he died before the Revolutionary War ended. A son of his became a great Prime Minister (see following article).

PITT, WILLIAM (1759-1806). One of the greatest of English statesmen was William Pitt the younger, son of the great statesman William Pitt, Earl of Chatham. The younger Pitt became Prime Minister before the age of twenty-five and, except for a three-year period, held that office until his death in 1806. He guided the country through some of its most critical times.

Never a robust person, Pitt received his early education at home from tutors until he entered Cambridge University. In 1780 he began the practice of law. A year later, at the age of twenty-one, he entered Parliament and in 1782 was appointed Chancellor of the Exchequer. As soon as he became Prime Minister, in 1783, he began to improve economic and political conditions by introducing reforms in government offices, reducing the national debt, and altering the loan system.

The great test of his strength came in 1793 when war broke out with France, but he weathered the strain successfully. Troubles with Ireland were partly settled in 1800 by the provision for legislative union; but his efforts to conciliate the Catholics by the passage of emancipation laws were opposed by the king. Pitt was forced to resign in 1801. But war with France again brought him back to power in 1804, and he laid the foundations for the alliance of Austria, Russia, and England against Napoleon.

The strain of the war, however, taxed his strength; and in 1806, shortly after Napoleon's victory at Austerlitz, Pitt died at the age of forty-seven.

PIT'TI PALACE. In 1440, Luca Pitti, magistrate of the republic of Florence, Italy, ordered Brunelleschi, the first great architect of the Renaissance, to design a great and magnificent palace. The architect lived to see only the first story completed, and the remaining two stories were not added until the sixteenth century. Nevertheless, this building, today a world-famed art museum and royal Italian residence, stands as an outstanding example of Renaissance architecture. It is connected with the Uffizi Palace by a passageway.

The art collection was begun by the Medici, who bought the palace from a member of the Pitti family. The exhibit, which contains many fine works of such masters as Raphael, Titian, Tintoretto, Andrea del Sarto, Rubens, Rembrandt, and Van Dyck, is displayed through thirteen beautiful halls of the structure. See **FLORENCE; UFFIZI**.



THE STEEL CITY'S GOLDEN TRIANGLE

Pittsburgh's towering office buildings and apartments look down upon a beautiful park at the meeting place of the Allegheny and Monongahela rivers. The point of the triangle was the site of historic Fort Pitt.

PITTSBURGH, Penn. Towering smoke stacks belching clouds of smoke, and giant blast furnaces roaring night and day, give to Pittsburgh the titles "Steel City," and "Smoky City." Pittsburgh is one of the greatest industrial centers in the United States, and no other city in the world surpasses it in the manufacture of iron and steel products. It is situated at the juncture of the Allegheny and Monongahela rivers, where they form the Ohio, in a region rich in coal, iron, oil, and natural-gas deposits.

Pittsburgh originally was built on a triangular site between the two rivers. As the city developed, it spread across the rivers, up their banks, and out over a large area in their valleys. It now covers an area of 54.5 square miles.

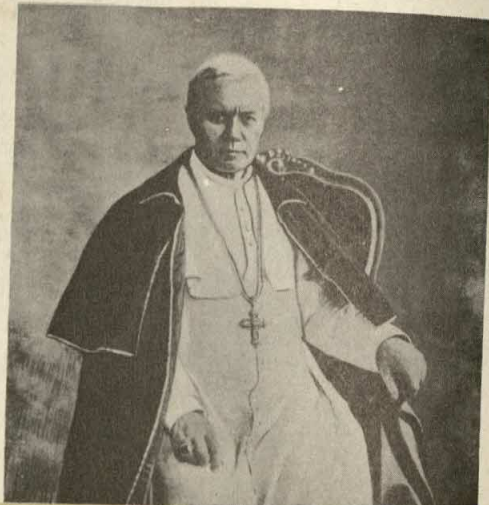
In the heart of the residential section is Schenley Park, containing famous Carnegie Institute of Technology, Carnegie Museum, and art galleries. On the Allegheny River is Highland Park, with beautiful zoological gardens. At the point where the rivers meet is the financial district, known as "the Golden Triangle."

Outstanding buildings are the Frick, Union Trust, Allegheny County, the Gulf, Koppers, Grant, Chamber of Commerce, and those included in the Civic Center.

Educational and scientific institutions include the University of Pittsburgh, Duquesne University, Carnegie Institute of Technology, Pennsylvania College for Women, Mellon Institute, Allegheny Observatory, and several seminaries.

In addition to the large steel plants in Pittsburgh, the largest of which is that of the United States Steel Corporation, there are such enterprises as printing and publishing, meat packing and slaughtering, petroleum refining, and the manufacturing of hardware, glass, electrical products, air brakes, instruments, and tobacco products. There are also large canning factories.

Fort Duquesne, erected in 1754 by the French, was built on the site of Pittsburgh. The British succeeded in capturing the fort in 1758, after an attempt had failed three years before. A new fort was built and named in honor of William Pitt, and soon a village sprang up, known as "Pittsburgh." It began to prosper after the establishment of the glass industry in 1797, and in 1811, with the beginning of steamboat transportation on the rivers, its development began in earnest. Pittsburgh was chartered as a city in 1816. Its population is about 607,000. It ranks sixteenth in population among United States cities.



TWO DISTINGUISHED POPES

International; Ewing Galloway, N.Y.

Left, Pius XI, who lived to see Vatican City re-established as a sovereign state. Right, Pius X, who was noted both for his learning and for his sympathy for the common people.

PIUS. Of the many Popes who took the name Pius, the following are best known:

Pius II (1405-1464) is remembered for his writings, for he was one of the most learned and worldly scholars of his day. He was elected Pope in 1458, after a career as diplomat and cardinal. An author and historian, Pius II was the only Pope to leave an autobiography.

Pius V (1504-1572) was elected Pope in 1566, and he is especially noted for rigidly enforcing the provisions of the Council of Trent. Both in political and religious affairs, he was regarded as an outstanding leader. Pius V was the last Pope to be canonized.

Pius VI (1717-1799) was Pope from 1775. Previously, he had held several important ecclesiastical offices, becoming a cardinal under Clement XIV. Pius VI condemned the French Revolution and, with the rise of Napoleon, he was forced to give up several Papal possessions.

Pius VII (1742-1823) began his career in the Church as a Benedictine monk, and was made Bishop of Tivoli by Pius VI. He soon became cardinal and was elected Pope in 1800.

Pius VII anointed Napoleon emperor in 1804, but he never had any love for the ruler

of France. After a falling out between the two, Napoleon seized the Papal States, and when Pius VII excommunicated the emperor, Napoleon arrested him and took him to Fontainebleau. The Pope, however, treated Napoleon's family well after the Battle of Waterloo.

Pius IX (1792-1878) was the last Pope to have secular authority until the temporal power of the Papacy was restored under Pius XI. During his thirty-two-year reign, beginning in 1846, Italy became unified, and the government took over the Papal States. When Rome was declared a part of Italy, in 1870, the Pope retired to the Vatican, regarding himself as a prisoner. In his reign the doctrine of Papal infallibility in faith and morals was announced by the Vatican Council. In 1854 Pope Pius defined the doctrine of the Immaculate Conception of the Virgin Mary.

Pius X (1835-1914) began as a simple priest and rose by successive steps to the Papal Chair. His first distinction came with his appointment as Bishop of Mantua, from which he was soon elevated to the College of Cardinals. He became Pope in 1903. He was an extremely generous man, and did much to alleviate the suffering of the poor. Though he lived austere, Pius X was a

patron of art and an accomplished musician besides being a scholar. He tried vainly to prevent World War I, which engulfed Europe in 1914.

Pius XI (1857-1939) was born Achille Ratti. He spent most of his early life in Milan, where for some time he was in charge of the Ambrosian Library. Eventually, he became librarian at the Vatican. In 1918 he achieved great distinction as the representative of the Holy See at Warsaw, where he did much to preserve amicable relations with Poland. He was appointed Archbishop of Milan and cardinal in 1921, and less than a year later was elected Pope upon the death of Benedict XV. Under Pope Pius the temporal power of the Papacy was restored through the Lateran Treaty, an agreement negotiated by the Pope and Mussolini, in 1929. See VATICAN CITY.

Pius XII (1876-1958) succeeded Pius XI in 1939. He was born Eugenio Pacelli, and was educated in his native Rome. Ordained a priest in 1899, he rose rapidly to high honors. In 1917, in the midst of World War I, Pope Benedict sent him on a peace mission to Germany, and he stayed there as Papal nuncio. Father Pacelli was created a cardinal in 1929, and in 1930 he became Papal Secretary of State. He ascended the Papal throne a few months before the outbreak of World War II. After the war, he urged all Christians to unite against Communism, "the infernal enemy."

PIZARRO, *pe zahr'ro*, FRANCISCO (about 1471-1541). Famed as the conqueror of Peru, Pizarro left Spain for the New World sometime before 1510. He was with Balboa when the Pacific was discovered, and in 1522 he led an expedition into South America. On his return to Spain, Pizarro received royal authority to conquer the new land. In 1532 he reached the rich domain of the Incas. Finding the country at civil war, he seized the ruler and demanded an immense ransom. The ransom was paid, but Pizarro had the chieftain put to death. In 1537, following a quarrel between



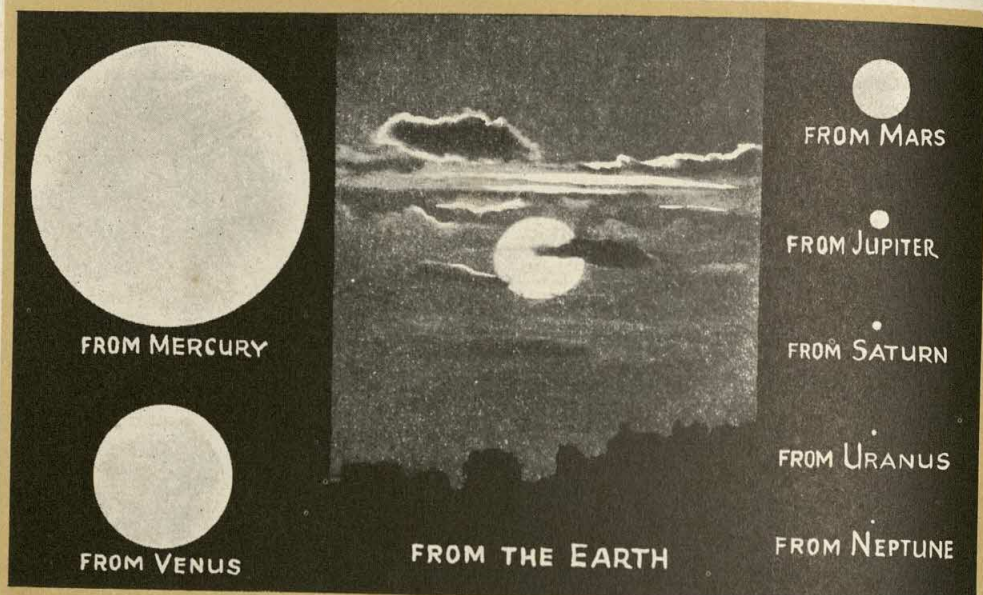
CONQUISTADORS AT INCA COURT

When Pizarro and De Soto visited the court of the Inca at Cajamarca, they were much impressed with the honors shown him by his retinue.

Pizarro and Almagro, the latter was strangled by Hernando Pizarro, Pizarro's brother. In turn, a son of Almagro took revenge by murdering Francisco in Lima, founded by Pizarro in 1535. See ATAHUALPA; BALBOA, VASCO; INCA.

PLAIN. In comparison with their surroundings, plains are the lowlands of the earth. A good example is the central plain between the Appalachian Mountains and the Rockies.

Throughout the history of the world,



HOW THE SUN WOULD APPEAR FROM VARIOUS PLANETS

Different distances from the sun make it seem larger or smaller. Pluto is so distant that from it the sun would be but a tiny star.

nearly all progress in civilization has been made on plains. Their topography—rolling or nearly level—makes transportation and communication easy, and with commerce there is always associated an exchange of ideas as well as of commodities. Plains are better suited for agriculture than plateaus or mountains because their slopes are less rugged; their soil is usually deeper and more fertile, and their altitude is better adapted to human life.

PLANE. Having no thickness, a plane is a surface any two points of which may be joined by a straight line which lies wholly within the surface. A side of a cube, for instance, is a plane. A plane has no curvature as well as no thickness. If it is a circle, it is a curvilinear plane. The side of a cube is a rectilinear plane.

PLANET. Before the telescope was invented, planets were thought to be wandering stars because they never seemed to stay put in the sky, as the other heavenly bodies did. In fact, the word *planet* is from the Greek word meaning *wanderer*. But when men could look through lenses, they found that the planets are worlds like our own,

some bigger, some smaller, but all spherical in shape, reflecting light from the sun, and revolving around that body.

Altogether there are nine planets. Mercury is closest to the sun, Venus is next; then come the earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto. Venus and Mercury are called *inferior* planets because their orbits lie between that of the earth and the sun; those whose orbits are beyond the earth's orbit are known as *superior*. Both inferior planets are smaller than the earth, but Mars probably is the only superior body that is not larger than our world.

The sizes have a wide range. Jupiter, 1,300 times larger than the earth, is the largest, and if its size could be represented by a 25-cent piece, Mercury, the smallest planet, would be an ink dot by comparison. Venus is almost as large as the earth, and Mars is about one seventh its size. Neptune is sixty times larger, Uranus sixty-four times, and Saturn, the second largest planet in the solar system, is 770 times as large. Pluto, the discovery of which was verified in 1930, is about the size of Venus, or about

.83 of the mass of the earth. It is approximately 3,700,000,000 miles from the sun, or about forty times farther than is the earth.

Every planet rotates on its own axis and revolves around the sun in an elliptical orbit. Those planets nearest the sun have the shortest orbits and the shortest *years* (*year* meaning the period of revolution). Mercury's year, for instance, is only eighty-eight of our days, while Pluto's is 248.43 of our years. Venus' year is 224.48 days; Mars', 1.88 years; Jupiter's, 11.86 years; Saturn's, 29.46 years; Uranus', 84.02 years; and Neptune's, 164.79 years. Despite the size of Jupiter, Saturn, Neptune, and Uranus, all four are less dense than the earth, Mars, Venus, and Mercury. Saturn, in fact, has a density less than that of water, and Jupiter weighs only 318 times as much as the earth.

The light of the planets in the sky is clear and steady as a rule, differing from that of the stars, which seem to twinkle because their light comes from such immense distances in space.

Consult the following articles for additional information:

Asteroids	Neptune
Astronomy	Satellite
Earth	Saturn
Jupiter	Solar System
Mars	Stars
Mercury	Uranus
Nebular Hypothesis	Venus

PLANETESIMAL HYPOTHESIS. See

GEOLOGY.

PLANETOID. See ASTEROIDS.

PLANT. Every person in the world is vitally interested in plants. One person may declare that he is interested only in books, and cares little about the out-of-doors; another may marvel that the farmer is content to spend so large a part of his time with vegetables and grains, when there are thousands of people in near-by cities and towns who might be studied or their friendship cultivated. Either would acknowledge, after a fleeting instant of thought, that he might conceivably live without books or without friends, but that

he could not exist for even a brief time without plants.

The three great needs—food, clothing, shelter—are all met by some product of the plant world, or by some product of a plant product. Everything that is placed on the dinner table, except water and salt, belongs, as the old game has it, to the "vegetable kingdom" or to the "animal kingdom," which is directly dependent on plants. Houses, furniture, books, silks, cottons, woollens—no one of them is more than two removes from a field or forest home.

Plants have played a wonderful part, too, in the development of civilization. Primitive man roved about, living on the animals he could catch, and the seeds, fruit, and roots which experience had taught him were not poisonous. How many thousands—perhaps hundreds of thousands—of years this stage of mankind's existence lasted, it is impossible to estimate. It was certain in time to occur to some man of unusual intelligence that the seeds produced each year by most plants were responsible for the next year's growth. A "master mind" of his day, a pioneer of civilization, might well have "invented" the wonderful process of planting seeds and producing extra crops. Such selection and cultivation of wild plants marked a very distinct stage in the upward progress of mankind. As one writer puts it, "The raising of crops checked the roaming of men."

Every plant in a wild state has its own particular habitat or situation in which it prefers to live. One of the earliest bits of knowledge the country child accumulates is that certain loved wild flowers have certain definite whereabouts. The daisies grow in the open fields, the marsh marigold along the swampy stream bank, the wild rose by the dusty roadside. The violet will grow in the open, but it prefers the wooded places. To the child, there may seem no far-reaching cause back of this. But the botanist has studied out the determining causes, and knows that the habitat of each wild plant is settled by the supply of water

available, the temperature, the sunlight, and wind.

In these volumes are numerous articles on the various phases of plant life. The distinctions between plants and animals are dealt with under **ANIMAL**. The article **BOTANY** discusses the divisions of the plant world, and such articles as **FERTILIZATION OF PLANTS**, **FLOWERS**, and **GERMINATION** tell how plants reproduce. There are also hundreds of articles on individual plants and plant families. See, also, **AGRICULTURE**.

PLANTAGENET, *plan tai'e net*. Fourteen kings of England were of the House of Plantagenet, which ruled from 1154 to 1485. They are said to have taken their name from Geoffrey of Anjou, because he wore a branch of broom (*planta genesta*) in his hat. In 1400 the house was divided into the Lancaster and York branches, which became the Tudor line in 1485. See **ENGLAND**.

PLANT LICE. See **APHIDS**.

PLASTER OF PARIS. When gypsum is ground into powder and heated to drive out a part of the moisture, the resulting product is plaster of Paris. Made into a paste by adding water and properly mixed, it will harden in a few minutes. The addition of lime makes the mixture much harder. Plaster of Paris is used for plastering, for surgical casts, for patching, for copying sculptured work, and in medicine and dentistry. It may even replace nails and screws for some purposes.

PLASTICS, *plas'tiks*. Modern chemistry has created an era of plastics; for materials which can be molded make possible mass production and low costs. Plastics come from many sources: from rubber, cellulose, casein, and resins. One of the first of the modern plastics was celluloid, used in making combs and other toilet articles, fountain pens, and the adhesive middle layer of non-shatter glass. Cellulose nitrate and cellulose acetate are used to manufacture photographic films.

Sometimes heat is used to mold plastics into the finished form; sometimes pressure is used. Waste sawdust can be pressed into

products harder than the original wood. Casein, derived from milk, is combined with formaldehyde to form a very hard material which takes beautiful colors; one of the uses of this plastic is the manufacture of fountain pens.

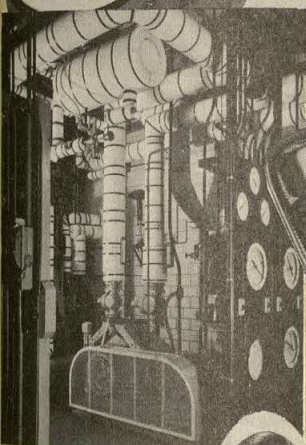
One of the most widely known plastics is Bakelite (a trade-mark name), made by combining phenol (carbolic acid) with formaldehyde and hardening it with heat. It is a non-conductor of electricity and is used for insulation, automobile parts, electrical appliances, and many other things.

Automobile and airplane parts are made from plastics. Plastic fabrics include rayon, nylon, orlan, and dacron. Synthetic rubber, golf-ball centers, and chewing gum are made from resins that were once waste products of the petroleum industry. A plastic glass that is light, flexible, and shatterproof has been developed. Colorful tableware is the plastic product of urea and formaldehyde. Even optical lenses are now molded of plastic glass at a fraction of the cost of grinding.

The important plastic fiber, nylon, is widely used for brush bristles. Such bristles dry quickly and are sanitary. Another plastic has the property of conducting light in only one direction; and rods of this material are used, in connection with surgical instruments, to illuminate operative areas. See **RESINS**; **SILK**, **SUBSTITUTE**.

PLATEAU, *plat oh'*. Plateaus, like mountains, are regions conspicuously higher than at least some of their surroundings, but differ from mountains in having broad summits. They often lie between plains on one side and mountains on the other. Thus, one may go from the Atlantic coastal plain westward and upward over the broad stretches of the Piedmont Plateau, then on still higher to the Blue Ridge Mountains.

Many plateaus are worn-down mountains, and the minerals buried in their rocks have been exposed by erosion, so that mining is an important industry. As an obstacle to transportation, large, high plateaus are usually more serious than mountains, for the latter may be tunneled.



*Hercules Powder Co.; Bakelite Company,
Division Union Carbide and Carbon Corp.;
Dow Chemical Co.; Du Pont Co.*



FROM STEAM PIPES TO POPCORN

Here are shown only a few of the multitude of uses to which plastics are put: plates, bowls, cups, and saucers; insulation for pipes; food-storage containers for the refrigerator; toilet articles of all sorts; chubby dolls to delight little girls; and popcorn vending machines to tempt the appetites of young and old.

Because of their unfavorable climate, rough topography, and inaccessibility, the high plateaus in the temperate zone are sparsely inhabited, but in the tropics the reverse is true. The plateaus of Mexico, Peru, and Bolivia are cool and more healthful than the hot, moist lowlands, so that most of the people in these countries live on the

plateaus.

PLATINUM. Expensive, brilliant, hard, and constant, platinum ranks with gold as the world's most valuable metal. Its greatest use is for jewelry; and in brooches, rings, bracelets, clips, and other ornaments it is highly prized. Dentists, too, value it, for it withstands heat better than does any

other metal, and cannot be dissolved by a pure acid. In chemical laboratories platinum is sought for the making of crucibles and evaporating dishes. Combined with iridium, another rare metal, it furnishes a fine engraving surface, and an alloy that does not vary with the temperature or atmospheric changes. For this reason, platinum and iridium alloy is the metal used for standards of length and weight.

Platinum, one of the heaviest of the metallic elements, is found in small grains along with iridium, osmium, rhodium, palladium, and ruthenium, which are known as the platinum metals. It was discovered in Peru, but the greatest known deposits of platinum in the world today are in the Ural Mountains. The leading platinum-producing lands now are Canada, Colombia, Russia, South Africa, and the United States (California, Oregon, and Nevada).

When polished, platinum is a gleaming metal, and in a pure state is almost as white as silver. It can be hammered and drawn out into a fine wire easily. Its symbol is *Pt*.

PLATO (about 428-347 B. C.). Still as fresh, clear, understandable, and as pertinent as they were when written, the dialogues of Plato contain the wisdom of a truly great philosopher. Plato was a student and follower of Socrates. He led the famed school that met in the Academy at Athens and was the first to state that the world of ideas is more real than the world we see, hear, and touch. This philosophy has influenced the thoughts of men ever since.

Plato's mother was related to the great lawgiver Solon, and his father was said to have been a descendant of Codrus, the last king of Athens. Plato was early influenced by Socrates, to whom he was devoted. After that great thinker's death, Plato wandered alone through Egypt, Northern Africa, and Sicily. Returning to Athens in 387 B. C., he founded the school of philosophy known as the Academy, where questions concerning life, truth, wisdom, knowledge, and, in fact, everything under the sun were dis-

cussed. His greatest student and disciple was Aristotle.

Of Plato's philosophy, two cardinal principles stand out. One is that the human being improves with knowledge, and the other that the mind is supreme over everything else. But Plato did not believe that knowledge should be attained merely for its own sake, but for the purpose of guiding one in life. It was his doctrine that our ideas are imperishable, that our concept of an elephant, a boat, or a dog cannot perish, although the thing itself, which is but a copy of the idea, can die. This philosophy is called idealism; it leads to the assumption that the soul is the real man which cannot die, but that the body has a short existence. It was only logical, then, that Plato should have believed in one God, and in the eternal soul.

Best known of the dialogues is the *Republic*, in which is outlined the ideal state, according to Plato's beliefs. Here we find the people divided into three groups—the rulers, the workers, and the military—each fitted for its own special task in the state. Plato's other dialogues include *Laches*, *Charmides*, *Lysis*, *Protagoras*, *Io*, *Meno*, and the *Symposium*, in which Socrates is the chief speaker; and *Euthyphro*, *Apologia*, *Crito*, and *Phaedo*, which describe Socrates' trial and death. See ARISTOTLE; SOCRATES.

PLATTE, *plat*. Rising high in Colorado and Wyoming, the Platte, one of the principal tributaries of the Missouri, begins its course as two rivers—the North and the South Platte. These branches flow separate courses until they reach Western Nebraska, where, in Lincoln County, they join to form the main stream. The Platte then flows a winding, eastward course and joins the Missouri just south of Omaha. The system drains about 90,000 square miles and is valuable for irrigation. However, neither the branches nor the main stream are of any importance for navigation.

PLEBEIANS, *ple be'anx*. Rome's early history was marked by the struggle of the common people to win political and civil

rights. These people were called plebeians and probably were the descendants of a people conquered before Rome was a great power. They won the right to vote and hold office in the third century B. C., but the name plebeian, ever since, has signified the lower classes in society. See **ROME**, **HISTORY OF**.

PLEIADES, *ple'a deez*. In the neck of Taurus, a constellation in the heavens in the shape of a bull, are seven bright stars, known as the Pleiades. Only six can be seen with the naked eye—Electra, Maia, Taygeta, Alcyone, Sterope, and Celaeno. The indistinct star is Merope.

PLINY, *plin'e*, **THE ELDER** (about 23-79). A Roman writer, Pliny the Elder was the author of a *Natural History* dealing with the science and nature study of his day. This work has survived the ravages of time. Pliny's full name was Gaius Plinius Secundus, and he was born of a wealthy family in Northern Italy. Educated in Rome, he entered the service of the government and traveled extensively, procuring information which he used in his writings. Pliny died in the eruption of Mount Vesuvius in the year 79, his death being described in the letters of his nephew, Pliny the Younger.

PLINY THE YOUNGER (about 61—about 113). Only a eulogy of the Emperor Trajan and a collection of letters remain of the writings of Pliny the Younger, but undoubtedly this nephew of the elder Pliny was one of the leading men of his day. His full name was Gaius Plinius Caecilius Secundus; after he had lost his father, he was adopted by his uncle, who bequeathed him his writings and estate.

A talented youth, he held several government posts and was consul in the year 100. Several years later he was chosen governor of Bithynia. It is supposed that he died about 113.

PLOVER, *pluv'ur*. Related to the sandpipers, plovers make up a large family of shore birds. They are commonly marked with black and white, have sharp whistling calls, and are remarkably strong on the



BIRD OF THE BEACHES

In migrating between the Arctic and South America, the golden plover travels 15,000 miles.

wing. A number of plovers are found in North America, perhaps the best known being the *killdeer*. Another species is the *golden plover*, or *greenback*, a bird about ten inches long, having, in summer, dark under parts and the upper parts spotted with black, white, and yellow. Like most other plovers, it is eagerly sought by sportsmen in the fall, when it is fat from feeding on berries.

The bird commonly known to sportsmen as the *upland plover* is not a plover at all, but a sandpiper (see **SANDPIPER**).



SOAKING UP SUN'S SWEETNESS

Juicy plums: delicious fresh, tasty in jellies.

PLUM. Wherever one travels throughout the United States and Canada, he will find the plum, a stone fruit of such popularity that it ranks third among fruits grown in the orchard. This delicious fruit

is eaten fresh, canned, dried as prunes, and used in jams, jellies, and preserves; its juice also is popular. Its many varieties, differing widely as to size, shape, color, and taste, include the Burbank, green gage, damson, and Lombard.

PLUTARCH, *plu'tahrk* (about A.D. 46—about 120). The biographies, called *Parallel Lives of Illustrious Greeks and Romans*, or *Plutarch's Lives*, written by this ancient Greek have brought him lasting fame throughout the centuries. Mostly written in pairs, with one Greek character study matched by a Roman one, the lives give an excellent history of ancient times and have served as source material for many later writers. Among Plutarch's many other works, his *Opera Moralia*, a collection of essays on ethics and philosophy, also is famous.

Born at Chaeronea in Boeotia, Plutarch studied in Athens, traveled widely in the Mediterranean countries, and taught philosophy in Rome.

PLU'TO. In Greek mythology, Pluto was the god of the underworld and ruler of the dead. The son of Saturn and Rhea and the brother of Zeus and Poseidon, Pluto ruled over Hades and was worshiped by men because they feared him. Wherever he went, his three-headed dog Cerberus, guardian of the gates of Hell, accompanied him. His wife was Proserpina, a beautiful goddess, whom he kidnapped.

Because gold, silver, and other minerals come out of the ground, Pluto was also the god of wealth. Our word *plutocrat*, referring to a wealthy person, comes from his name.

PLUTO. In 1905 the noted American astronomer Percival Lowell conjectured that a still-undiscovered planet caused certain irregularities in the movements of the planet Uranus. It was not until 1930, however, that the long search conducted by the Lowell Observatory at Flagstaff, Ariz., resulted in the discovery of the heavenly body whose existence he had predicted.

The ninth planet to be found, Pluto takes some 248 years to complete one revo-

lution around the sun. Its distance from the sun averages about 3,700,000,000 miles. Yellowish and reflecting light very faintly, Pluto can be seen only with a powerful telescope. It is believed to be very cold, dry, and incapable of supporting life as we know it. Its mass is about .83 of the earth's mass; the density of the two is about the same. Pluto is thought to have little or no atmosphere and no satellites. See **PLANET**; **SOLAR SYSTEM**; **URANUS**.

PLUTONIUM, *plu toh'nih um*. This highly explosive, radioactive chemical element is used in producing atomic power and weapons. Its atomic number is 94; its atomic weight, 239; its symbol, *Pu*. Plutonium is artificially produced by bombarding nuclei of the U-238 isotope of uranium with neutrons released by the fission (splitting, explosion) of nuclei of U-235, another uranium isotope. The process thus started produces U-239, then neptunium-239, another artificial element, which is so unstable that it rapidly changes into plutonium. When plutonium explodes, breaking into other elements, a tremendous amount of heat is given off.

Plutonium was first obtained in 1940 by the American scientists G. T. Seaborg, E. W. Kennedy, E. M. McMillan, and A. C. Wahl. See also **ATOM-SPLITTING**; **CHEMISTRY**; **URANIUM**.

PLYMOUTH, *plim'uth*, **COLONY**. Founded in late December, 1620, by a group of English separatists, called Pilgrims, this was the first permanent settlement in New England. Today, Plymouth Rock, the boulder on which the Pilgrims stepped in debarking from the *Mayflower*, attracts thousands of visitors yearly to the picturesque, historic town of Plymouth, Mass.

During their first winter in the tiny settlement of rude homes built back from the coast, the Pilgrims suffered from cold, a lack of food, and a strange disease that killed forty-four of them, including John Carver, their governor. But when spring came, the undaunted pioneers tilled the soil, received help from friendly Indians,

PNEUMATIC TIRES

fished, and hunted game in the wilderness. The success of the colony encouraged the planting of other settlements in North America, and its founders not only established the first self-government there, but also deeply influenced the conduct and thinking of its people. See MASSACHUSETTS; MAYFLOWER; PILGRIMS.

PLYMOUTH COMPANY. Although it had a charter to found colonies in New England, the Plymouth Company accomplished nothing. It was organized in 1606 by merchants of Plymouth and Bristol, England, who received a grant from King James I to settle between the Rappahannock River and Maine. One settlement in Maine was attempted in 1607, but it was abandoned the next year. The Plymouth Company went out of existence in 1620, when the Council of New England was formed.

PNEUMATICS, *nu mat'iks*. So important are the various gases to man that the science of physics deals with them, their properties, and their behavior, both at rest and in motion, in the special study known as pneumatics. Particularly does this include the study of the atmosphere, its weight, density, pressure, motion, and elasticity, and its power to conduct heat, sound, and light. The principles of pneumatics are applied in the designing of gas pumps and compressors and machines which depend upon air pressure for their motive power.

Consult the following titles for additional information:

Air Brake	Gas
Atmosphere	Pneumatic Tires
Compressed Air	Pneumatic Tools
Pneumatic Tubes	

PNEUMATIC TIRES. The pneumatic tire has played a great part in increasing the number of automobiles traveling the world's highways. In early automobiling days, most cars had solid-rubber tires, which were long-lasting and held to the road. But these soon gave way to pneumatic, or air-filled, tires, which make for more comfortable rides by absorbing road shocks when cars travel at high speeds. Today's

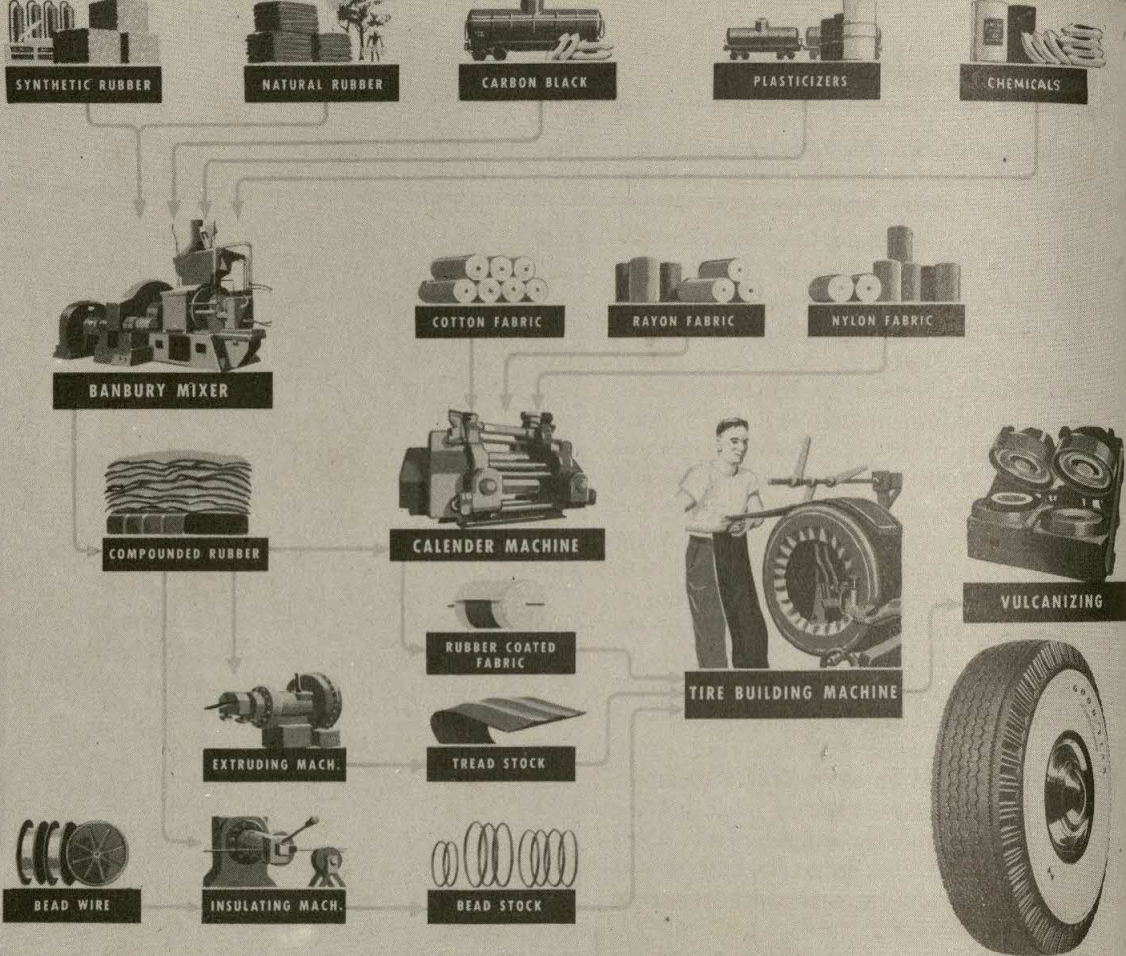


Australian Official Photo

SMALL BOY — BIG WHEEL

A giant earth-moving machine uses tires like this one, costing thousands of dollars each.

pneumatic tires, made from natural or synthetic rubber, are used on many other vehicles besides passenger cars and trucks. Tires formerly consisted of an inner tube and a casing. Most modern tires are tubeless. Tubeless tires are lighter than inner tube tires, and they run cooler and deflate slower when punctured. Some con-



MORE THAN A MERE RUBBER RING

Tire manufacture involves many materials and processes designed to increase the strength and life of tires and improve safety and comfort in transportation.

tain a gummy substance which automatically closes small punctures. Others have an inner chamber of rubberized nylon on which the car may safely run after a blowout.

The tire industry uses most of the world's natural rubber and an even greater amount of synthetic rubber. The United States produces more than 1,000,000,000 tires yearly.

PNEUMATIC TOOLS. Of special use in the various types of building and highway construction are pneumatic tools, which operate entirely on compressed air. In general, they are of two types—those which operate as hammers, and those which deliver their power in a rotary motion. Nearly all of them are hand-operated, the air being carried to them from the compressor at a pressure varying from 80 to

125 pounds per square inch. The amount of air is regulated by a valve.

To the hammer type belong such tools as rock drills, calking machines, riveting hammers, and chipping tools. A good riveting hammer can deliver as many as 20,000 blows per minute. The rotary tools are used for high-speed grinders and buffers.

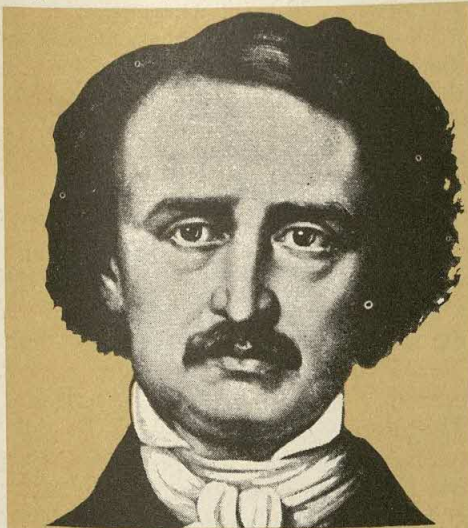
PNEUMATIC TUBE. Operated by compressed air, pneumatic tubes are used in some offices for the transfer of mail, telegrams, money, and small packages. Often, the tubes run underground from station to station. The message or parcel is transmitted in a small carrying case, made so that it forms a practically airtight plug when placed in the tube. Then by means of an increase of the air pressure in

the tube back of them, or a reduction of the pressure in front of them, the cases are "shot" through the tubes at a speed of twenty to thirty miles per hour. Pneumatic tubes thus result in the saving of many steps and dollars. Systems employing pneumatic tubes are called *pneumatic dispatch*. See COMPRESSED AIR.

POCAHONTAS (about 1595-1617).

Stories of Pocahontas, the Indian maiden, tell how she saved John Smith from death at the hands of her tribesmen and how she prevented the Indians from destroying the colony of Jamestown, Va. Regardless of the truth of these stories, it is known that she was the daughter of Chief Powhatan and that she knew Captain Smith when the settlement was founded.

In 1612 she was captured by the English and kept as a hostage for white prisoners taken by the Indians. After adopting Christianity, she married John Rolfe. He took her to England in 1616. Their son was educated in England, but he returned to Virginia some years later.



MASTER AMERICAN AUTHOR

In spite of a brief productive period, Edgar Allan Poe won world fame for poetry and prose.

POE, EDGAR ALLAN (1809-1849). Poetry that combines the rhythm of stirring music and the sounds of beautiful and powerful words characterizes the art of Edgar Allan

Poe. Beautifully written, too, are the weird and masterful short stories of this writer.

Poe, who was a native of Boston, led an unhappy life. His mother died when he was only three years old, and he was adopted by a Virginia family named Allan. At the University of Virginia he was addicted to gambling, and he left the institution to serve three years in the army. Then he attended West Point, but was dismissed for disgraceful conduct. Breaking with the Allan family, Poe endeavored to make his own living. He wrote poetry and a short story, *A Manuscript Found in a Bottle* which won a prize in 1833. He then worked on the *Southern Literary Messenger*, in Richmond, Va., until 1836, and married his cousin, Virginia Clemm, in that year.

Poe loved his wife deeply; and when she died, in 1847, he was stricken with inconsolable grief. He took to drink and died in two years.

Poe's work reflects the unhappiness of his life and the unrest of his soul. Throughout his poems, such as *The Raven*, *The Bells*, *Annabel Lee*, *Ulalume*, and *To Helen*, there is an undertone of sadness and pessimism; and such short stories as *The Fall of the House of Usher*, *The Masque of the Red Death*, and *The Gold Bug* illustrate his inclination toward the mysterious. Poe's short stories are, however, among the finest in American literature and are loved by young and old alike.

POET LAUREATE, *law're ate*. England rewards an outstanding poet with the title of poet laureate, an honor created in the time of Ben Jonson. The poet laureate is appointed by the reigning monarch and is paid a nominal yearly salary. However, he is not required to write anything special, or even to be installed. It is customary, however, for the poet laureate to commemorate state occasions with poems.

Although Ben Jonson was the first poet laureate formally appointed, there were a number of poets before him who are now called "volunteer laureates." These, the later poet laureates, and their dates, include:

Name	Born	App't'd	Died
Geoffrey Chaucer.....	1340?		1400
John Gower	1330?		1408
John Kay			
Andrew Bernard			
John Skelton	1460?		1529
Richard Edwards	1523?		1566
Edmund Spenser	1552?		1599
Samuel Daniel	1562		1619
Ben Jonson	1573	1619	1637
Sir Wm. Davenant....	1606	1638	1668
John Dryden	1631	1670	1700
Thomas Shadwell	1642?	1688	1692
Nahum Tate	1652	1692	1715
Nicholas Rowe	1674	1715	1718
Laurence Eusden	1688	1718	1730
Colley Cibber	1671	1730	1757
William Whitehead ...	1715	1757	1785
Thomas Warton	1728	1785	1790
Henry James Pye	1745	1790	1813
Robert Southey	1774	1813	1843
William Wordsworth...	1770	1843	1850
Alfred Lord Tennyson.	1809	1850	1892
Alfred Austin	1835	1896	1913
Robert Bridges	1844	1913	1930
John Masefield	1875	1930	

POETRY. The language of the soul is poetry, daughter of religion and twin sister of music. It holds the distinction of being the first literary contribution of man.

Today, such a thing seems difficult to believe, for the everyday language of the modern world is in prose. Yet, all investigation discloses that poetry flourished as the means by which the ideas, customs, and history of one generation were preserved for the next, long before prose was written. This early poetry, however, was not the poetry of rhyme and verse that is so familiar. Instead, it was a language that could be sung or chanted to music in the temple, to the sun, to the moon, or whatever force earliest man worshipped. Gradually, the chants and hymns became separated from the actual notes of music, but it still maintained the rhythm and emotional appeal that characterize poetry.

Later, this poetry became separated from religion and was dedicated to heroes who committed brave deeds. This change marks the beginning of poetry which tells a story. It is of two types: the epic, a long poem about heroic figures, and the ballad, a short narrative poem, which is rhythmical and can easily be sung.

It must be remembered that poetry was created long before it was set down in writing. Poems were handed down by word of mouth. For instance, the *Iliad*, the great epic poem of Greece, probably was recited by many people before it was written. So, too, the ballad of Robin Hood was sung by minstrels for many years before it was recorded on paper. From these early poetical forms have developed prose stories, the drama, the elegy, idyl, lyric poetry, ode, pastoral, sonnet, and other forms of literature.

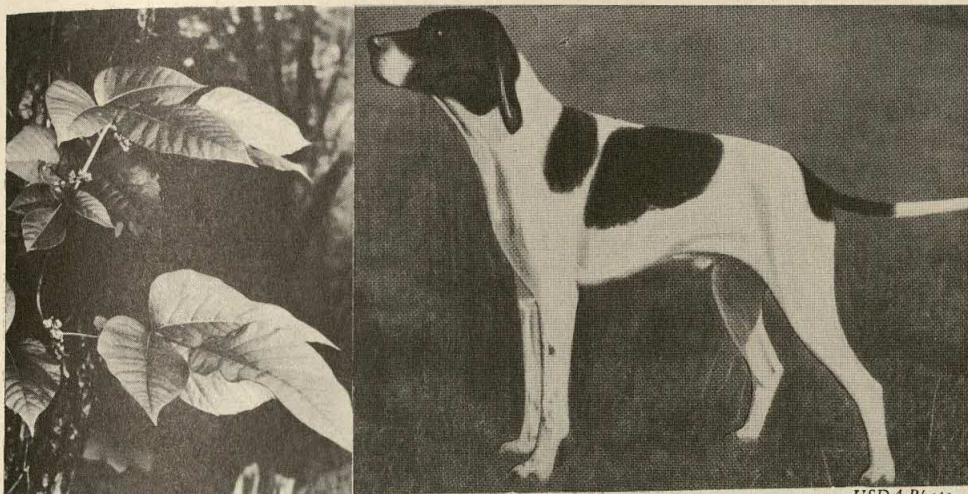
The poet expresses his emotions in language woven in pleasing patterns, just as a painter expresses his emotions in color and design; the composer, in musical tones; the sculptor, in exquisitely chiseled marble; and the architect, in the creation of a magnificent cathedral. And he who in everyday living experiences an exaltation of spirit at the beauty of a sunset, or the wind in a sail, or the creation of a great artist, is himself a poet at heart, even though he may be unable to write a poem, compose a symphony, or carve a statue.

For additional information, consult the biographies of numerous poets included in these volumes. See, also, the following:

Ballad	Literature
Blank Verse	Lyric Poetry
Epic	Poet Laureate
Idyl	Sonnet

POINSETTIA, *poin set'i a*. Because of its brilliant coloring, the poinsettia is widely used as a Christmas floral decoration. It is a member of the spurge family and was introduced into the United States from Mexico by Dr. Joel R. Poinsett, the first minister from the United States to Mexico. The greenish, woody stem gives off a milky substance when cut. The plant grows from two feet to ten feet high and bears bright-green leaves and also brilliant-red leaves (or bracts) which look like flowers and are sometimes a foot across. At the center of the cluster of red leaves is a small, yellow flower.

POINTER. This sporting dog is used to trail game and indicate where it is hiding so that it may be shot. Pointers are clean-



HUNTER'S FRIEND — HIKER'S FOE

USDA Photo

The hunter who follows his pointer (right) through the fields must beware of poison ivy (left).

cut dogs, with an average weight of about sixty pounds. Their hair is short and stiff, their tails long and slender, their ears drooping, and their bodies built for endurance. Their best quality is their ability to smell game and to control themselves when near the hiding grouse, pheasant, or other bird which they are assisting their masters to find. For this purpose they are invaluable.

POISON GAS. First employed for military purposes by the Germans during the First World War, poison gas, inhumane as it was, came to be used as an important weapon by both the Allies and the Central Powers. The first gas was created in tanks and was liberated as a greenish-yellow cloud when the wind was blowing in the right direction. It was a chlorine preparation and caught the Allies totally unprepared, bringing agonizing death to many troops. Later, "gas shells" were shot from guns. Tear gas, causing temporary blindness, and mustard gas, a terrible, burning vapor, were also used. Both sides adopted "gas masks," which filtered the poison from the air. During World War II, gas masks were issued to soldiers and civilians, but no poison gas was used.

POISON IVY. Probably the most widely known of American poisonous plants,

poison ivy is found in nearly all parts of the United States and in Canada from Nova Scotia to British Columbia, and many people are poisoned by it every year.

Poison ivy is a low, erect shrub or a woody vine which sometimes ascends trees. It belongs to the cashew family and to the sumac genus, and is easily distinguished from plants with which it might be confused, by being "three-fingered"; that is, the leaves are composed of three leaflets. The harmless Virginia creeper, which in Eastern United States grows in similar places and is sometimes called ivy, has five leaflets. The small flowers of poison ivy are yellowish-green; the fruits are white or ivory-colored when ripe, and remain on the plant most of the winter. Directions for treating ivy poisoning are in the article **FIRST AID TO THE INJURED**.

POKEWEED. Common all over the eastern half of the United States, the pokeweed also goes under the names of *American nightshade*, *pigeon berry*, *garget*, and *inkberry*. It usually reaches a height of three feet, has purple branches, and bears small, white flowers, which are followed by juicy, purple berries. The plant is sometimes employed for medicinal purposes, and some people eat its shoots in early spring, yet parts may be poisonous.

The Land of Tragic History



POLAND. For centuries the battleground of warring European nations, Poland became an independent republic after World War I. The creation of a free Polish state was one of Woodrow Wilson's Fourteen Points, and the republic, as authorized by the Treaty of Versailles, lasted for twenty years. Then, on September 1, 1939, the armed forces of Adolf Hitler invaded Poland, and within a month it was divided between Germany and Russia. This was the fourth partition of the unhappy country; three times before, in the eighteenth century, the Poles had seen their land partitioned by greedy neighboring nations. A Poland with new boundaries emerged from World War II. The settlement of its eastern frontier gave some disputed territory to the Soviet Union; the western boundary was extended into defeated Germany to compensate for this territorial loss in the east.

Extent of the Polish Republic. At the outbreak of the war in 1939, Poland had an area of about 150,000 square miles and a population of about 35,339,000; today the area is about 119,800 square miles and the population about 29,000,000. The republic is bounded on the east and northeast by Soviet Russia, on the west by Germany, and on the south by Czechoslovakia. In

order to give Poland access to the sea, the Treaty of Versailles had created a Polish Corridor along the Vistula River; this strip of territory, taken from German West Prussia and Posen, was about 260 miles long and 80 miles wide. The port of Danzig, at the mouth of the Vistula, together with a surrounding district, became the Free City of Danzig. To the northwest of this port, on the Gulf of Danzig, an arm of the Baltic, the Poles built the modern seaport of Gdynia. The Polish Corridor and Danzig were restored to Poland in 1945, after the country was liberated.

Physical Features. The land is chiefly a vast rolling plain sloping to the north. The southern edge is skirted by the Carpathian Mountains. Across the plain a number of rivers flow in a northwesterly direction, the most important being the Vistula. Timber covers about a fifth of the area. The rest of the land is well adapted to the raising of wheat, rye, barley, oats, potatoes, sugar beets, flax, hemp, and hops. The abundant mineral resources include iron, petroleum, zinc, and coal.

Government and Education. The chief executive is the President; he is assisted by a Council of Ministers. There are also the legislature, or the Sejm, and the Council of State.

Now under Russian influence, the Polish People's Republic is Communist. Its constitution, government, and politics follow the usual Soviet pattern.

Free, compulsory elementary education has somewhat reduced Poland's high illiteracy rate since World War I. Its University of Cracow is Eastern Europe's oldest university, founded in 1364. Polish is the national language, but Russian must be taught from the fifth grade upward.

The People. Most Poles are descendants of the West Slavonic Polians (meaning *field dwellers*), who settled the area in the 400's. Christianized in the 900's, the Poles are mostly Roman Catholics. Despite the country's centuries-old anti-Semitism and ghettos, some 3,000,000 Jews lived there in 1939, but most of these were murdered in the Nazi concentration camps of World War II. Other minority groups include Russians, Ukrainians, and Lithuanians. After World War II most of the German inhabitants of present-day Poland were deported to their motherland, and Poland also lost thousands of its own people—Polish refugees in other lands who refused to return to a Communist state.

For years Poland's wealth, land, and

forests were largely owned by a small, powerful upper class, while most of her people were poor peasants. But the great estates have now been split up among the landless, machinery has been introduced, and primitive methods of farming have been replaced by more modern ones.

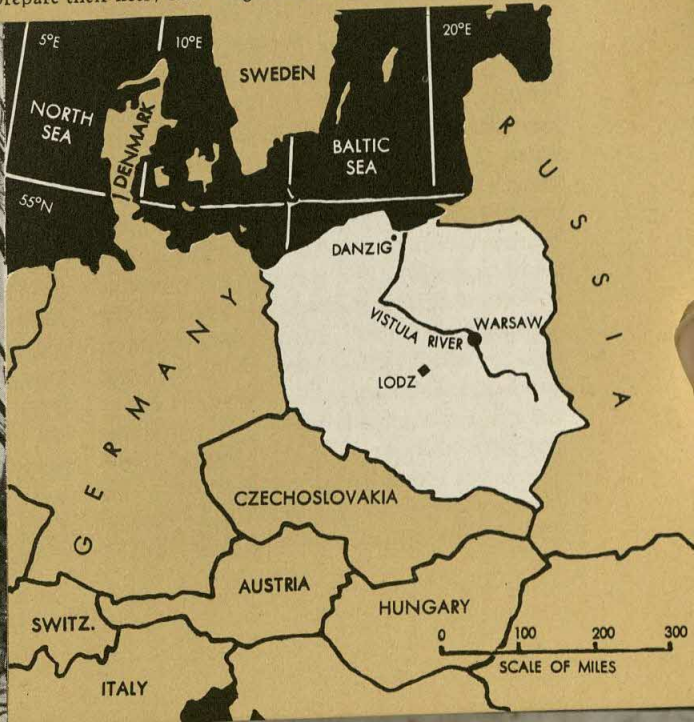
Industries. Before World War II, some 65 per cent of all Poles were farmers. Since, then, however, industrialization has been so stressed by the government that many former farmers are now factory-working city dwellers. Poland's industries include fishing, lumbering, mining, petroleum and sugar refining, meat packing, flour milling, canning, and ore smelting. Among its manufactures are steel, heavy machinery and other metal products, chemicals, electrical goods, clothing, footwear, furniture, paper, glass, porcelains, and cement. Coal and coke are its leading exports. Polish hams and bacon have long been in great demand abroad.

Transportation. Like almost everything else in Poland, rail, air, and highway facilities had to be rebuilt after World War II. But its postwar territorial gains gave it a much longer Baltic seacoast, the former German port of Stettin (now

Polish Government Information Center

MAPS MAY CHANGE, BUT LIFE GOES ON

Below left, Polish fishermen prepare their nets; below right, a location map of Poland.



Szczecin) at the mouth of the navigable Oder River, and the great port of Danzig, or Gdansk. These, with Gdynia and an extensive network of rivers and canals, make water transportation important.

History. Poland first became a united kingdom in the late 900's and reached the peak of her power and expansion between 1386 and 1572. But after the partitions of her territory among Prussia, Russia, and Austria in 1772, 1793, and 1795, she ceased to exist as a nation until after World War I.

The defeat of Germany and Austria in that conflict and Russia's occupation with her internal revolution finally enabled the Poles to realize their dream. On November 9, 1918, Poland's independence was proclaimed, and in the following year the Treaty of Versailles recognized the new republic. For a time the Poles had a little taste of democracy, but in 1926 Marshal Josef Pilsudski became dictator.

On September 1, 1939, German troops invaded Poland without a declaration of war and began one of history's most destructive campaigns. When Britain and France immediately joined bravely fighting Poland, World War II in Europe was under way. On September 17, Russian troops entered East Poland, and on September 29, Russia and Germany divided the country between themselves. After only twenty-one years of independence, Poland again ceased to exist as a free nation. After the German invasion of Russia in June, 1941, Poland came under the control of the Nazis alone and remained so until 1945. Then the country again became a battlefield as Polish and Russian soldiers fought the Germans back home.

Few countries suffered more destruction of life and property during the war than did Poland. The capital, Warsaw, was practically demolished, as were many of the other cities and towns and the countryside. Throughout the conflict the Polish people fought both at home and abroad for an Allied victory, more than 6,000,000 of them becoming war casualties or vic-

tims of the cruel Nazi occupation.

Despite the opposition of many Poles, a Communist government was established after liberation, and Poland came under Russian domination. Under postwar agreements, she lost to Russia nearly 70,000 square miles in the east, including most of her best forests and oil fields. On the west, she gained from Germany some 39,000 square miles, which gave her complete ownership of the mineral-rich Silesian industrial area, with its valuable coal deposits, and several important Baltic ports. In 1946 most of the nation's resources and industries were nationalized, and in the next year the government adopted a planned-economy program. Poland is a charter member of the United Nations.

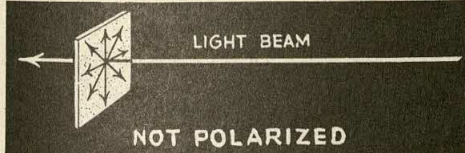
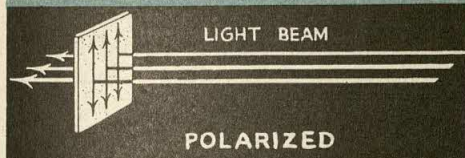
See also the following articles:

Chopin, Frederick	Paderewski, Ignace
Copernicus, Nikolaus	Pulaski, Casimir
Curie, Pierre and Marie	Versailles, Treaty of
Danzig	Warsaw
Kosciusko, Thaddeus	World War I, II

POLARIZED LIGHT. In ordinary light the vibrations are in all directions in a plane perpendicular to the light rays (see WAVES); but in *plane polarized light* they are limited to a single direction in that plane (see diagram). A device that polarizes light by letting through the vibrations in only one such direction is a *polarizer*, which is usually made of tourmaline, Iceland spar, or Polaroid.

Some of the sunlight reflected from water or pavement is polarized with vibrations horizontal. The reflected glare is reduced by Polaroid sunglasses or windshields that transmit only vertical vibrations. Such filters are useful on cameras, binoculars, and lamps. In showing three-dimensional motion pictures, left-eye and right-eye views are projected through two polarizing screens, one view in horizontal vibrations and the other in vertical ones. Each lens of the spectacles used to view the projected pictures transmits only one set of vibrations, thus letting the viewer's left eye see only the left-eye view, and his right eye only the right-eye view.

In sugar refineries the concentration of



Courtesy Popular Mechanics

POLARIZED LIGHT

Light does not get through overlapping areas of the two "crossed" transparent disks above, since each one transmits vibrations at right angles to those transmitted by the other.

a sugar solution is determined from the amount it rotates the plane of polarization of light; and manufacturers detect internal strains in glassware by colored patterns produced when the ware is placed between crossed polarizers (see picture).

POLE. At one point on the earth's surface, all directions are south. This point, the North Pole, is one end of the earth's axis of rotation. The other end is the South Pole, where all directions are north. These *geographic* poles are equally distant from the equator: the N. Pole in a frozen sea at 90° N. latitude; the S. Pole on a snow-covered continent at 90° S. lat.

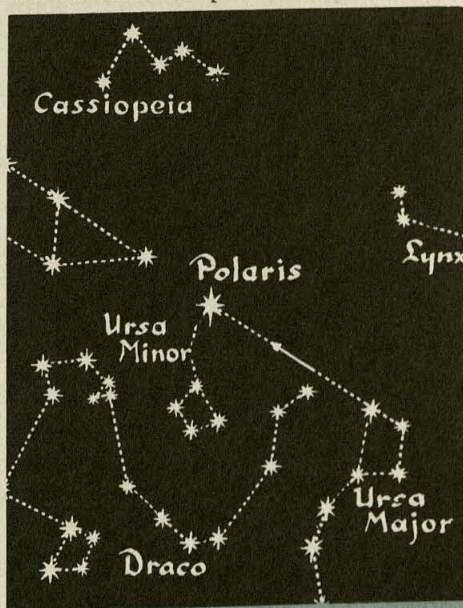
In general, when a compass needle points north, it does not point toward the

N. Pole but toward the north *magnetic* pole on Prince of Wales Island northwest of Hudson Bay. The south magnetic pole is south of Tasmania on the coast of Antarctica. See **MAGNETISM**; **POLE STAR**.

POLE/CAT. Often confused with the skunk, the polecat is a fur-bearing carnivorous native of Europe. Its nearest relative in North America is the ferret, a small animal often used for hunting. The polecat usually grows to be about two feet long. The upper fur is brownish in color, the lower extremities and tail are black. The ears and muzzle are marked with white. Poultry, rabbits, rats, mice, frogs, fish, snakes, and eggs comprise its diet. Polecat hair is valuable in the manufacture of artist's brushes. Like the skunk, the polecat gives off an offensive odor. See **SKUNK**.

POLE STAR, or NORTH STAR.

While not the brightest star in the sky, the Pole Star is probably one of the most important. It is approximately that point in the heavens toward which the North Pole of the earth points. The ease with



THE NAVIGATOR'S GUIDE

For centuries, sailors have depended upon Polaris, the North Star, to chart their courses.

which it can be located and the fact that it is always visible in the Northern Hemisphere make it valuable as a guide for mariners. The lack of such a conspicuous star above the South Pole is correspondingly disadvantageous for southern seafarers unaware of their exact position.

The Pole Star is easily located by means of the Big Dipper, or Great Bear constellation, a star group with which practically everyone in the Northern Hemisphere is familiar. The two pointer stars of this constellation, Alpha and Beta, are almost in line with the Pole Star, and since there is no other bright star in its vicinity, it may easily be identified.



“~all’s well!”

POLICE, *po lees’*. Bodies of trained officers sworn to maintain law and order make up the organized police of cities or larger jurisdictions. In the United States, police forces were formerly maintained only by municipalities, but now many states and counties have police systems, sometimes called *constabularies*.

Both city and country forces are motorized; a large number of them maintain



(1) Courtesy Thomas Cook & Son

PROTECTING LIFE AND PROPERTY

(1) Modern Roman policeman. (2) On highway patrol. (3) Efficient Netherlands police on parade.



FIGHTING CRIME AT HOME AND ABROAD

Fast communication, by wire and radio, has increased the efficiency of the police. (1) San Francisco police central. (2) Dignified French police. (3) A Canadian "mounty."

radio stations and automobiles equipped for two-way radio communication. In cities the police are usually commanded by a superintendent appointed by the mayor, or are headed by a commissioner. Under this chief officer are captains, lieutenants, and

sergeants commanding the patrolmen, as police are called. The main body of policemen patrol a specified district or "beat," protecting property and apprehending criminals, while others are assigned to special service, as the detective bureau, traffic

division, ambulance and pulmotor squads, sanitary division, missing-persons bureau, air patrols, etc. Some forces use police-women and matrons for certain duties. Federal police agencies in the United States include the F.B.I. and the Secret Service. See CRIME; FINGERPRINT INVESTIGATION; JUSTICE, DEPARTMENT OF; ROYAL CANADIAN MOUNTED POLICE; SECRET SERVICE.

POLIOMYELITIS, *polih oh myeh li' tis*. This disease, often called *polio* or *infantile paralysis*, attacks the central nervous system of both children and adults. Despite the vast amount of research devoted to learning about it, much remains unknown. During epidemics, doctors advise everyone to observe all rules for good health and to avoid crowds. A doctor should be seen at the first symptoms, which include fever, nausea, headache, restlessness, stiff neck and back, and sore throat.

Polio occurs the year round but becomes epidemic during the summer and fall. Three types of viruses are known to cause the disease. In a severe form, polio may cause death or the permanent paralysis of some part of the body. In their constant efforts to wipe out polio or at least reduce the danger of serious paralysis, doctors have tried out many different methods and medicines, including injections of gamma globulin. Mild attacks of polio often go unrecognized.

POLITICAL ECONOMY. See ECONOMICS.

POLITICAL PARTIES IN THE UNITED STATES. It is only natural for people holding like views on public questions to form themselves into groups and through mass strength attempt to translate their political theories into action. For this reason, political parties have existed in America since before the Revolutionary period. During that era there were but two parties: the defenders of English authority were called *Tories*; their opponents, who demanded an ever-increasing degree of self-government, were termed *Whigs*. As the tension increased, many

Tories fled to Canada or to Europe, and the ones who remained were relegated to political obscurity.

With the formation of the Articles of Confederation, two new factions arose. One group, the *Federalists*, favored a strong, central government; the other, the *Anti-Federalists*, desired nothing more than a loose confederation, with each state maintaining its own sovereignty (see FEDERALISTS; ANTI-FEDERALISTS). For twelve years (1789-1801) the Federalists were in the ascendancy, although Washington was the unanimous choice of both factions. Washington took a definite nonpartisan stand, placing both Hamilton, the leader of the Federalists, and Jefferson, the strong Anti-Federalist, in his Cabinet.

The last Federalist President, John Adams, was elected largely through the support of Washington and Hamilton. The Federalist party thereafter waned as a power, and passed completely out of existence following the Hartford Convention of 1814.

The two major parties of today, the Democratic and Republican, regard Jefferson and Hamilton as the original founders of their respective political groups.

The Democratic Party. A short time before the election of Jefferson, in 1800, he managed to assemble his Anti-Federalist support under the name of *Republican* party that included all who were opposed to the policies of the Federalists. Later the name was changed to *Democratic-Republican*, and finally to *Democratic*, the present title of the party. The Democrats won every election, except three, from 1800 to 1860. The exceptions were: the election of John Quincy Adams in 1824 by the *National-Republicans*, a branch of the Democratic-Republicans which favored internal improvements and a protective tariff; and the elections of William H. Harrison in 1840 and Zachary Taylor in 1848, by the Whigs.

When, during James Buchanan's administration, the slavery question became a

burning issue, the Northern and Southern Democrats broke apart, and the Republicans came into power with the election of Abraham Lincoln. Not until 1884 did the Democrats win an election. Their successful candidate, Grover Cleveland, was handicapped by a hostile Congress, and was defeated in 1888 by Benjamin Harrison. Cleveland's second term (1893-1897) was marred by a severe panic, and the Republicans were again in power until the election of Woodrow Wilson. In 1912 Wilson defeated the regular Republican candidate, William H. Taft, because of a split in the party. The Democrats were again displaced in 1920 by Warren G. Harding, but in 1932 they came back in the midst of a serious economic depression that arose during the administration of Herbert Hoover. Franklin D. Roosevelt, elected in that year, was re-elected in 1936, 1940, and 1944.

Many reform measures were put into effect in an effort to restore prosperity, and the administration policies were sometimes contrary to time-honored party traditions. In 1948 Harry Truman, also a Democrat, was elected on a "Fair Deal" platform similar to that of Roosevelt's "New Deal." But in 1952 the party lost the Presidency after holding it for twenty years.

The Republican Party. This party was a result of the national strife over slavery, and contributing to its organization were abolitionists, anti-slavery Democrats, anti-slavery Whigs, Know-Nothings, Free-Soilers, and members of the Liberty party; all had one idea in common—the non-extension of slavery in the United States. The party name was adopted at a meeting in Lansing, Mich., in 1854. The first national convention was held in Philadelphia, in June, 1856. The first Presidential candidate of the Republicans was John C. Fremont, who was defeated by his Democratic opponent, James Buchanan, in November, 1856. Within two years, however, the party had obtained an anti-slavery majority in fifteen states and had elected eleven Senators to the upper house of Congress. By

1860 it had a majority in both houses and succeeded in electing Abraham Lincoln President.

When Lincoln was assassinated, in 1865, his Democratic Vice-President, Andrew Johnson, became President. Johnson's administration was marked by quarrels with Congress over reconstruction policies and he was impeached (though not convicted) for overstepping his authority. In 1868 the Republicans joyfully elected Ulysses S. Grant as President, and until Wilson's election, in 1912, they held uninterrupted control except for Grover Cleveland's two terms beginning in 1885 and 1893. Woodrow Wilson served two terms (1913-1921). Following Wilson's administrations, there were three Republican Presidents—Harding, Coolidge, and Hoover. In 1932 the Republicans were unable to overcome the public prejudice that was aroused by the depression, and the Democratic party came into power, then held the Presidency until 1953, when the Republican Dwight Eisenhower, a military hero, took office.

Policies. Both major parties have often shifted their policies. Generally, though, the Republicans have been more conservative, favoring big business and agricultural interests; the Democrats have been more liberal and more friendly toward labor and the small farmers.

Other Parties. Among the earliest of the "third parties" that have waxed and waned was the *American party*, whose members were called *Know-Nothings* (see KNOW-NOTHINGS). It originated in New York and Philadelphia in 1835, reaching its height in 1852. The party advocated repeal of the naturalization laws, the exclusion of foreigners, and the choice of none but native Americans for public office. Especially strong in the South, the party soon declined and many of its members joined the Republicans.

The *Whig party* was founded in 1834 by a merging of National-Republicans, Anti-Masons, and anti-Jackson Democrats. Its most famous leaders were Daniel Webster and Henry Clay; its platform called

for a liberal interpretation of the Constitution, a protective tariff, and a United States Bank. The Whigs succeeded in electing two Presidents—William Henry Harrison in 1840 and Zachary Taylor in 1848. After the party divided on the slavery question in 1852, it disintegrated, the Whigs in the North joining the Republicans, those in the South merging with the Democrats.

The *Liberty party* was the first of two anti-slavery organizations and lasted only from 1839 to 1848. At its head was the abolitionist, William Lloyd Garrison. Three conventions were held, though the party had absolutely no effect on national elections. It merged with the Free-Soilers in 1848, and both joined the Republican ranks shortly afterward.

The *Constitutional-Union party* of the South was made up of remnants of Whigs of the North and Know-Nothings of the South. At its height in 1860, it mustered thirty-nine electoral votes for John Bell, its nominee.

The *Prohibition party*, advocating the abolition of the manufacture and sale of liquor, was founded in 1869 and still exists. Although it has never won a national election, it has been influential in arousing sentiment against the use of liquor.

The *Liberal Republican party* was organized in 1872 as a protest against reconstruction policies of Congress.

The short-lived *Greenback party* was organized in 1874 by those opposed to the resumption of specie payments.

The *Populist*, or *People's party* originated in 1891; its membership was composed chiefly of laboring classes. Its platform called for free coinage of silver, government ownership of utilities, a national banking system, an income tax, and the popular election of United States Senators. The Populists polled twenty-two electoral votes in 1892. The Populist party was the outgrowth of the Grange and Farmers' Alliance movements.

The present *Socialist party* is the outgrowth of the Social Democratic party

organized by Eugene V. Debs and Victor Berger in 1897. It has never carried a state in Presidential elections, but has elected Congressmen and local officials. Its platform has generally advocated public ownership of natural resources, key industries, money, banking, and credit; shorter hours, higher wages, and other benefits for workers; and political changes to make the national government more responsible to the voters.

The United States has had four *Progressive parties*. The first, formed in 1912 and nicknamed the "Bull Moose" party, ran Theodore Roosevelt for President. The Democrat, Woodrow Wilson, was elected, but Roosevelt polled more votes than the Republican, Taft. The Progressive party of 1924, led by Robert M. La Follette and endorsed by the Socialists, received almost 5,000,000 votes but carried only Wisconsin. The National Progressive party, led by La Follette's sons in the 1930's and 1940's, had little influence outside Wisconsin. A fourth Progressive party backed Henry Wallace for President in 1948 and Vincent W. Hallinan in 1952.

The *Communist party*, which follows the political "line" of Soviet Russia, has never had popular support in America.

The *Farmer-Labor party*, which championed improved farm and labor conditions, had great strength in Minnesota for a number of years following 1922.

The *American Labor party*, backed by the left-wing element of the C.I.O. in New York, split in 1944. The right wing became the *Liberal party*.

More about the political history of the United States may be found in the separate articles on the Presidents.

POLK, poke, JAMES KNOX (1795-1849). America's first "dark horse" President was colorless and almost unknown James K. Polk, who, nevertheless, proved to be an industrious and honest executive.

His administration, from 1845 to 1849, saw the settlement of the Oregon territory dispute with England, a war with Mexico, and the acquisition of a large area in the

West. In addition, the winning of the West was advanced by the discovery of gold in California, the slavery question became more threatening, and American industry made notable progress during his four years in office.

Early Career. The eleventh President of the United States was born in Mecklenburg County, N. C., on November 2, 1795. Polk was graduated from the University of North Carolina with honors at the age of twenty-three. He studied law in Nashville, Tenn., and there was admitted to the bar in 1820. Setting up practice in Columbia, Tenn., he became interested in local politics, and won a seat in the state legislature in 1823. Two years later he was elected to Congress, and from 1835 to 1839 he served as Speaker of the House. In the latter year he was elected governor of Tennessee but was defeated for re-election in 1841 and 1843.

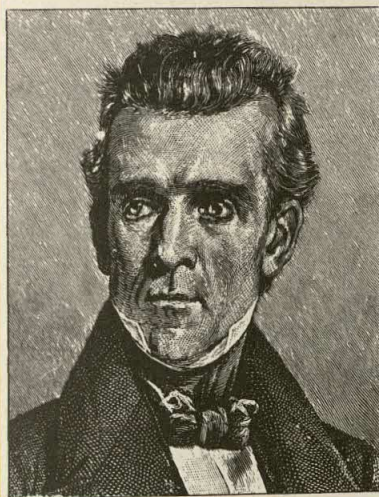
Despite his prominent posts, Polk had remained an obscure personality to the mass of American people, and when the Democratic party held its convention in Baltimore in May, 1844, he was not regarded as a probable candidate. Martin Van Buren was looked upon as the strongest candidate, with Lewis Cass as an alternate. The convention, however, was unable to agree on either of these men, and on the ninth ballot, Polk was nominated unanimously.

The Democratic party's platform, aimed at pleasing the North by advocating the acquisition of the Oregon territory as far

north as parallel 54° 40", and pleasing the South by promising to acquire Texas, gave Polk an advantage over his Whig adversary, Henry Clay. Aided by a split among the Whigs, Polk was elected by an electoral vote of 170 to 105.

His Administration.

Before the close of the first year of his term, Texas was admitted as a state, and disputes over the state's boundaries brought on the Mexican War in the following year (see MEXICAN WAR). After the defeat of Mexico, by the Treaty of Guadalupe Hidalgo (1848), the United States acquired California and what is now Nevada, Utah, most of Arizona and New Mexico, and parts of Wyoming and Colorado. In Polk's term the Wilmot Proviso was introduced into Congress, providing that slavery should be ex-



JAMES K. POLK

Eleventh President of the United States
Administration, 1845-1849

During President Polk's term of office, Texas was annexed to the country, the Mexican War was waged, and the Oregon country was organized as a territory. Thus the nation was greatly expanded.

cluded from any new states formed. It passed the House, but not the Senate.

Turning to the Oregon controversy, the President settled it peaceably, and in 1846 the boundary of Northwestern United States was placed at the 49th parallel.

Pledged to a low tariff in the campaign, Polk signed the Walker Tariff Bill, which provided for a tariff for revenue only. He also approved an act establishing an independent-treasury system, and true to his views, vetoed a bill for river and harbor improvements on the grounds that Federal funds should not be used to benefit special sections of the country.

During his term, Iowa and Wisconsin were admitted as states; the Naval Acad-

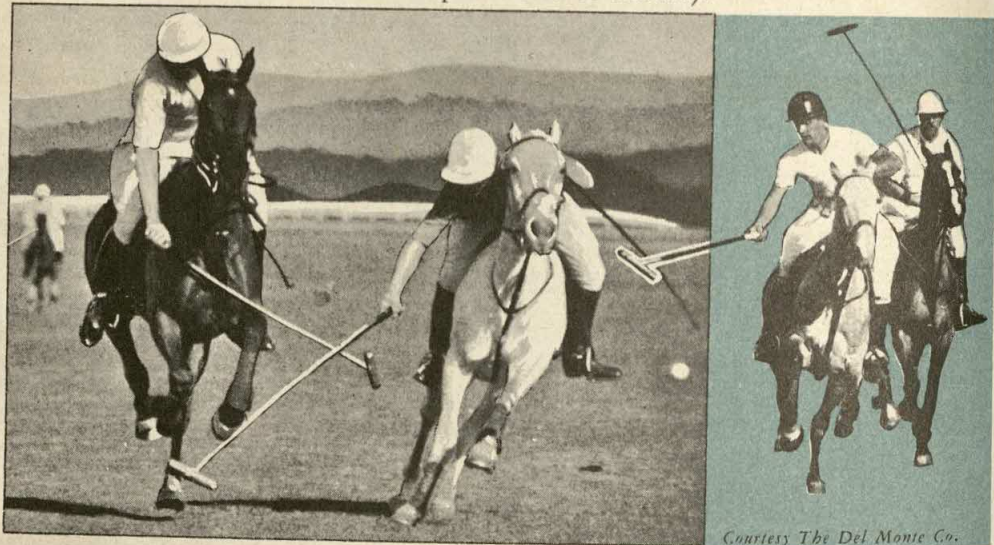
emy at Annapolis was founded; Elias Howe patented his sewing machine; and Hoe invented the rotary printing press.

Polk was not nominated in 1848 for a second term, and General Zachary Taylor succeeded him. Within a few months after leaving office, Polk died.

POLLEN. "Do you like butter?" cries the child, and holds a blossom under his playmate's chin. The yellow powder which indicates whether or not the little playmate "likes butter" is pollen, one of the most essential factors in the life of a flower, since without it seeds or fruit could not be pro-

duced. It is borne in the anther, or little case at the top of the stamen, and when the anther opens it falls or is carried to the stigma which crowns the pistil.

Here each tiny pollen grain begins to grow in its own way, sending down through the pistil a delicate thread tube, finer than the very finest spider's web ever spun. This thread touches an ovule, stored in the bottom of the pistil, and this at once responds to the influence, becoming an embryo, or "baby seed," which holds within itself a potential new plant (see FERTILIZATION OF PLANTS).



Courtesy The Del Monte Co.

THE SPORT OF PRINCES

Polo is a thrilling game to watch and is exhilarating to players and ponies alike. The international matches draw thousands.

POLO. The most ancient "ball and stick" game, polo originated in Persia more than twenty centuries ago. It is enjoying increasing popularity in the Western World. The game resembles hockey. It is played from horseback, the ball being hit with a long-handled mallet. Formerly, polo was played from a pony mount, but today there is no restriction as to the height of the horse, except that the mount must be of suitable height for the player.

The game is played on a field 900 feet long by 450 feet wide. The goal posts are twenty-four feet apart, at least ten feet high, and light enough to break if the players

collide with them. The ball is three and one-eighth inches in diameter, five ounces in weight, and is made of wood. The mallets are fifty to sixty inches long.

Four men usually constitute a team, or side. Numbers one and two are the *forwards*, three the *halfback*, and four the *defender* of the goal and immediate territory. A goal counts as one point, a *safety* minus one-quarter, and a *foul* minus one-half. A safety is made when a player, to save his goal, hits the ball behind his own goal line. A referee determines when a foul is committed, and his decision is final.

The time of the game is divided into



PRISON PRODUCES A TREASURE

Only imprisonment by the Genoese gave Marco Polo, great explorer of the Middle Ages, time to dictate the story of his adventures.

eight periods, or *chukkers*, of seven and one-half minutes each, with three-minute intervals between all periods except after the fourth period, when a seven-minute interval is allowed.

A polo player must be a good rider, able to control the reins with one hand, and especially clever in making sharp turns and reverses. Long years of practice are required for the attainment of proficiency.

POLO, MARCO (about 1254-1324). Because two men once took a youth to China, all Europe stirred from its feudal sleep to answer the call of far-off pagoda bells and bring back the riches of the East. The youth was Marco Polo, whose tales of the mysterious East and the splendor of the Mongol Empire caused an age of wandering and adventure that brought about the discovery of new worlds and new ways of living.

Marco was a Venetian, the son of Nicolo Polo and the nephew of Maffeo Polo, merchant seaman. The father and uncle journeyed overland to China, and on their return resolved to go again. On their next trip, in 1271, they took young Marco with them, and Venice was not to see the three again for twenty-four years. In China, Marco learned the language and became a

favorite of the great Kublai Khan. When he grew older, he entered the service of the Khan, performing many valuable missions for him. He was even governor of one of the cities for three years. Then the great Khan died; and the three Polos, who were now in Persia in the company of a Mongolian princess, decided to return home. They reached Venice in 1295, full of stories of adventure and strange sights.

Marco never returned to China, for in 1298 he was captured in a war with Genoa. But while he was in prison, he dictated his story, *The Book of Marco Polo*. This book, after Marco had left prison and had died, had a powerful influence on men, and it was not long before the caravans of Europe's merchants were regularly traveling to the East.

POLYP, pol'ip. Among the tiniest and simplest of water animals are the polyps, soft, jelly-like creatures which grasp their food from the water by means of waving tentacles which surround the mouth. Most of them live in colonies, fastening themselves to stones at the bottom of fresh or salt water. They reproduce rapidly, and a giant mass of polyps soon collects, such as the coral. Some, like the jellyfish and fresh-

water hydra, move about freely in the water and refuse to colonize. See COELENTERATA; CORAL.

POMEGRANATE, *pom' gran it*. In Southern Europe and Asia Minor, the orange-red tomato-shaped pomegranate is prized for its edible pulp, which makes a pleasing cool drink. Wine is also made from the pulp, the flowers and rind are used in medicine, and the tannin of the rind is employed in making morocco leather. There are many Biblical references to the pomegranate. It is grown successfully in the southern part of the United States, where the glossy leaves and brilliant-red

blossoms of the small, long-lived tree make it popular as an ornamental.

POM'PANO. The word *pampano* is Spanish for *grape leaf*, and *pompano* is a corruption of it. The name is roughly descriptive of the shape of a fish which has a wide reputation as one of the most delicious food fishes in the world. The pompano, which belongs to the family of the amberfishes, is a favorite in New Orleans and other cities of the Gulf and South Atlantic coasts.

The "California pompano," or poppy fish, which is often sold under the name of pompano, is a relative of the barracuda.



A CITY BURIED FOR SEVENTEEN CENTURIES

Magically the ruins of Pompeii recapture for us a nearly complete picture of life as it was in the first century A. D. (1) A street.

(2) Restored grocery. (3) How a dog died.



POMPEII, *pom pa'ye*, ITALY. Citizens of thriving Pompeii went peacefully about their customary tasks in the year A. D. 79. It is true that sixteen years before, near-by Mount Vesuvius had rumbled and there had been a severe earthquake. But the people believed that the volcano was extinct and so had rebuilt their city and thought no more about eruptions.

Then one August day in A.D. 79, a mighty roar rose up from the bowels of the earth. Smoke poured from Vesuvius; flames darted out; and streams of volcanic ash

descended upon the city. The terror-stricken citizens fled, carrying with them such valuables as they could. Down came more and more ashes, finally burying the city which had existed since the sixth century B. C.

Centuries passed, and Pompeii was forgotten. In 1748 an Italian peasant digging in his vineyard near Mount Vesuvius struck a portion of the ruins of the ancient city. Thus, after nearly 1,700 years, Pompeii was discovered. The remains of the city were in a remarkable state of preservation, owing

to the deep covering of volcanic ashes which had sealed them up. Extensive excavations have revealed a typical Roman provincial city.

Pompeii extended east and west in the form of an oval, surrounded by a wall with eight gates. Its narrow, straight streets are just as they were long ago; ruts made by chariot wheels are still visible. The forum with its temples and public buildings was in the center of the city. Shops and homes may still be seen, just as their owners left them. Loaves of bread were found in ovens; kitchen utensils were found lying about where they had been left in ancient days. Beautiful wall paintings, statues, and other works of art have been preserved.

Visitors to Pompeii may wander about the ancient city and see how its people lived. Restorations still being carried on by the Italian government will eventually show Pompeii as it was before the great tragedy. See VESUVIUS.

POMPEY (GNAEUS POMPEIUS MAGNUS) (106-48 B. C.). Talented in the military affairs of Rome and powerful in politics, Pompey made one mistake in his life that proved to be his undoing. He opposed Caesar.

Pompey rose to fame early. When still a youth, he massed three legions to aid Sulla in his struggle against Marius and won back the African territories. Upon returning to Rome, he was given an ovation and the title of Magnus (Great). After winning additional victories in Spain, he was elected consul with Crassus in 70 B. C., and three years later ended piracy on the Mediterranean. In 63 and 62 B. C., he triumphed in Palestine and Asia Minor and won more honors when he returned to Rome.

Joining Crassus and Caesar, he became a member of the First Triumvirate. Also, he married Julia, Caesar's daughter. Appointed consul while Caesar was away, he turned against the great commander and had him proclaimed an enemy. Caesar marched against Pompey in 49 B. C., and Pompey fled to Greece. After pursuing him, Caesar defeated the forces of Pompey at

Pharsalia and became sole ruler of Rome. Pompey escaped to Egypt but met death by stabbing at the hands of one of his soldiers. See CAESAR, CAIUS JULIUS; ROME, HISTORY OF.

PONCE DE LEON, *pon' tha da la ohn'*, JUAN (about 1460-1521). Coming to America on Columbus' second voyage, this Spanish explorer became governor of Haiti, then conquered Puerto Rico and became its governor. On a voyage northward in search of a fabled "fountain of youth," Ponce de Leon discovered Florida on Easter Sunday, 1513, naming it *Pascua Florida* (Flowery Easter). He also rounded its tip and believed it to be an island. Returning to Florida in 1521 to found a colony there, Ponce de Leon was wounded by hostile Indians. He was then taken to Cuba, where he soon died.

PONTIAC (about 1720-1769). By organizing a confederation of nearly all the Mississippi Valley's Indian tribes, this Ohio-born Ottawa chief sought to aid France in her war against England and to stop white settlement of the valley. His warriors' attacks of 1763 were so fierce that only Forts Niagara and Detroit withstood them. But, in 1766, after the cessation of the French-English struggle, "Pontiac's Conspiracy" ended when he had to make peace with the English. While avenging his murder by an Illinois Indian in 1769, the Ottawas and their allies practically wiped out all the Illinois tribes.

PONY EXPRESS. The story of the daring horseback riders of the Pony Express as they sped across the wilderness and defended themselves against Indian and bandit attacks is one of American history's most colorful chapters. Yet the service, established by a private freighting firm to carry mail between St. Joseph, Mo., and San Francisco, Calif., existed only about eighteen months. Started on April 3, 1860, it was put out of business by the transcontinental telegraph on October 24, 1861. Its charge for carrying mail was \$5.00 an ounce.

The nearly 2,000-mile trip took ten



A LION OF THE STAGE

Poodles, with leonine haircuts, are popular pets as well as amazing actors in dog shows.

days at first, but was later made in eight or nine. Relay stations along the route kept fresh horses saddled and waiting for arriving riders. Each man covered about 140 miles before another took over. See CODY, WILLIAM.

POODLE. Intelligent, friendly, and born actors, poodles are popular pets, both easily and often trained for use as stage, circus, or hunting dogs. Some weigh up to fifty pounds; others, only a fifth as much. Those under fifteen inches tall are classed as *miniature*, or *toy*, *poodles*. Poodles may have short or long, tightly kinky or ropy hair of any one of several colors — white, brown, gray, reddish, or black. Their coats are often clipped in odd patterns.

POOL. Less scientific than billiards, but similar to it, pool, or *pocket billiards*, is played on a rectangular table, having six pockets, one at each corner and one in the middle of each side. *Pyramid pocket billiards*, one of the most popular forms of the game, is played with a white *cue ball* and fifteen others, progressively numbered or distinctively colored. Each player uses a tapered, leather-tipped stick called a *cue*. The fifteen balls are racked in a triangular, or pyramid, formation at the foot of the table. The lead-off player strikes the cue ball with his cue and tries to "break" the pyramid. From then on, his cue ball must

be played from where it lies, and each player tries to hit the most colored balls into the pockets.

POPE. The supreme head of the Roman Catholic Church is the Pope. He is also the Bishop of Rome and, according to Catholic belief, is Christ's representative on earth. The claim to supremacy is based on the tradition of the Church and the Scriptures, and the decision of the Vatican Council which declared the Roman bishop the universal head of the Church as the successor to Peter, who was considered ordained as the first head of the Church by Christ.

The power of the Pope extends over the entire Roman Catholic Church and all its members, in moral and religious matters. His powers are great, since he controls every department of the Church and every phase of Church life. However, his power is not absolute; he is limited not only by his conscience, but also by the councils, customs, and teachings of the Church. The insignia of the Pope are the triple crown, the straight crosier, and the pallium. The Pope is addressed as "Your Holiness."

Popes of the Roman Catholic Church are elected by a two-thirds vote of the College of Cardinals, and any male Catholic is eligible for the position, although the Pope is generally chosen from the cardinals.

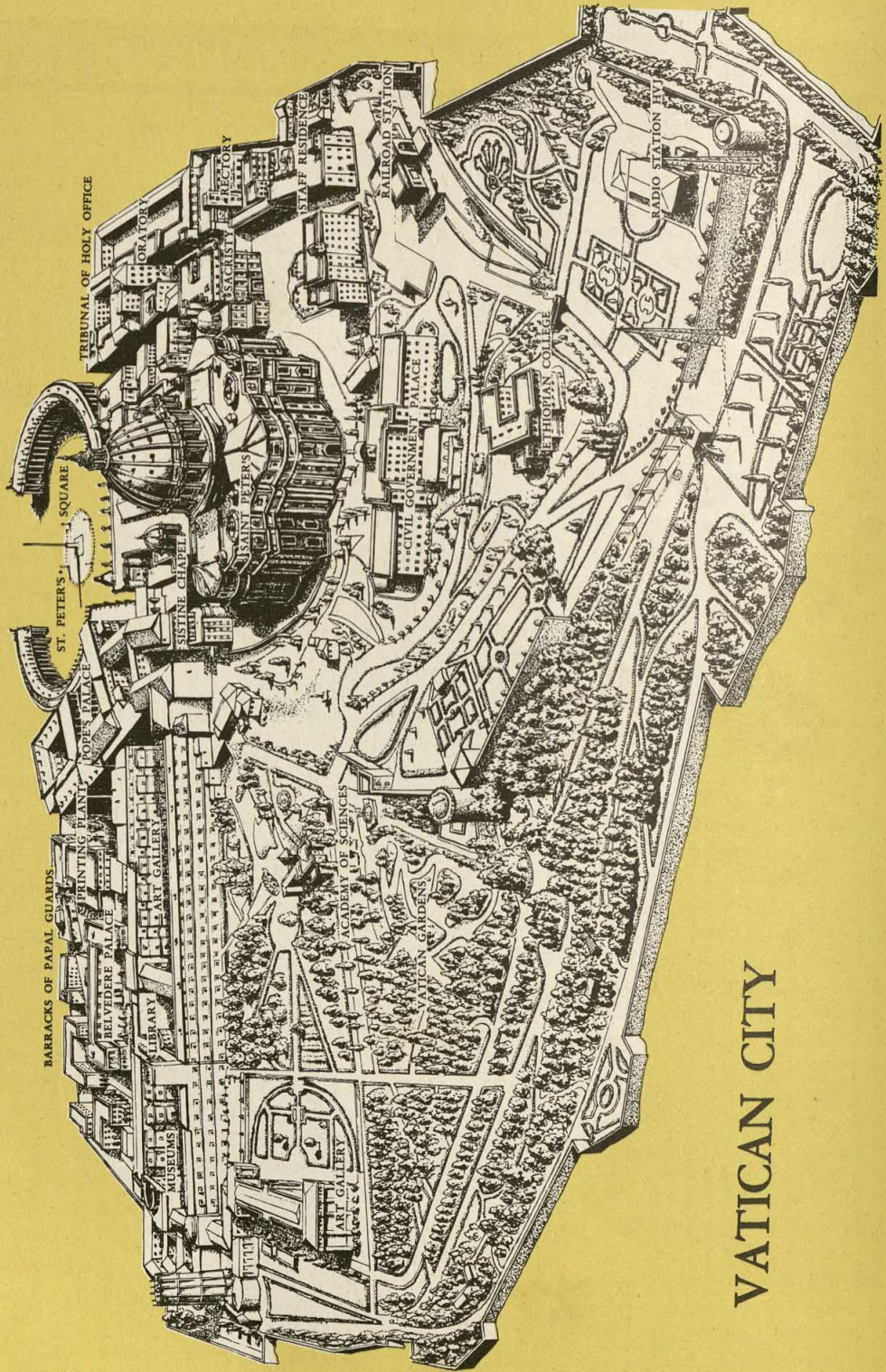
History of the Papal Authority. The early Popes were chiefly concerned with strengthening and spreading the temporal and spiritual authority of the Church both in the Eastern and Western worlds. Pope Leo I (440-461) proposed a plan for a system of vicariates in the East and West, but the plan met only temporary success in the East. In the West, however, the power of the Pope in both religious and governmental affairs grew rapidly. In 754-756, Pippin the Short, a Frankish king, gave the Pope land in Italy, which was made a Papal dominion over which the Pope was sole ruler.

From then on, the power of the Church and the Pope grew considerably, especially during the Middle Ages, when learning flourished only in the monasteries. At that



JOHN XXIII, HEAD OF THE CATHOLIC CHURCH

The domain of the Pope is Vatican City, which lies entirely within the city of Rome, but is not part of the Italian capital. His residence is the Pope's Palace, a twelfth-century structure near St. Peter's. The Sistine Chapel, where papal elections are held, is his private chapel.



VATICAN CITY



SCENES IN VATICAN CITY

Upper left, the Pope conducts the ceremony of canonization from the throne of Saint Peter's, Rome (right)
Lower left, Papal insignia.

time, judicial power not only over the Church but also over the common people fell to the bishops, and the Pope came to be regarded as the center of all knowledge and justice, princes and kings being regarded as the agents of the Papal authority. The Crusades also did much to consolidate Papal power, because they centered resources and power in the hands of the Church and people looked to the Pope as the source of all authority.

However, with the crowning of Otho I as Holy Roman Emperor in the tenth century, there began the great struggle between the Pope and the kings for supremacy in governmental affairs. Otho's defiance split all Europe into two factions, the imperial and the Papal; but the Papal group remained in the ascendancy until the early part of the fourteenth century. During the reign of Innocent III (1198-1216), nearly all the princes of Europe acknowledged the

sovereignty of the Pope in governmental and political as well as in religious matters.

Then the power of the Church as a temporal authority began to decline. Two events served to break the hold which the Church had over state affairs—the "Seventy Years' Captivity" and the Reformation. In 1309 the Papal residence was removed to Avignon, France, where the Papal power was under French influence until 1417. During this time, the rulers of France, Germany, and England renounced the temporal supremacy of the Pope and declared themselves supreme in matters of politics and government, although they continued to recognize the Pope's spiritual authority.

The next blow was the Reformation, which culminated in a challenge not only to the Pope's temporal power but also to his spiritual authority. From this time, the Pope ceased to exercise any great control

in governmental affairs, and today the Pope is recognized only as a spiritual leader.

In 1870 the Papal States were joined to the kingdom of Italy. Since as head of the Church he could not recognize the sovereignty of any political ruler, the Pope remained within the Vatican from 1870 to 1929. In 1929 the Papacy was again made a temporal power in an independent Papal State.

When Italy entered the Second World War, in 1940, the Papal State was forced by Mussolini to submit to censorship of the Vatican newspaper and radio broadcasts.

See for further information:

Papal States	Sacred College
Roman Catholic Church	Vatican City
(with full-color picture of Pope John XXIII)	

POPE, ALEXANDER (1688-1744). Master of witty satire and stinging invective, Alexander Pope holds an outstanding place in English literature of the eighteenth century. His major poems, written in unsurpassed heroic couplets, are filled with sharp and well-turned phrases that have since been incorporated in the English language.

Pope was born in London, but when he was thirteen he moved with his family to Binfield, where he continued a somewhat haphazard education. Having learned Greek and Latin, he turned his attention to literature, and in 1709 published a volume of *Pastorals*. Two years later he wrote his famed *Essay of Criticism*, and in 1714 published *The Rape of the Lock*, a satirical poem directed at fashionable society of the day.

Two years later, the poet undertook a translation of the *Iliad* and *Odyssey*, a task which occupied him for thirteen years. Although the work was financially successful, it is said that Pope lost the spirit of the original. In 1728 he wrote the *Dunciad*, a bitter condemnation of hack writers, intended to silence his detractors. Colley Cibber, who was then poet laureate, was criticized by him in an addition to this volume in 1742. His later works were *Imitations of Horace*, and *Moral Essays*, the

latter containing the noted *Essay on Man*.

Pope's bitterness toward society and his suspicion of Addison and other writers is attributed to the fact that he was almost constantly in ill health and that he was partially crippled.

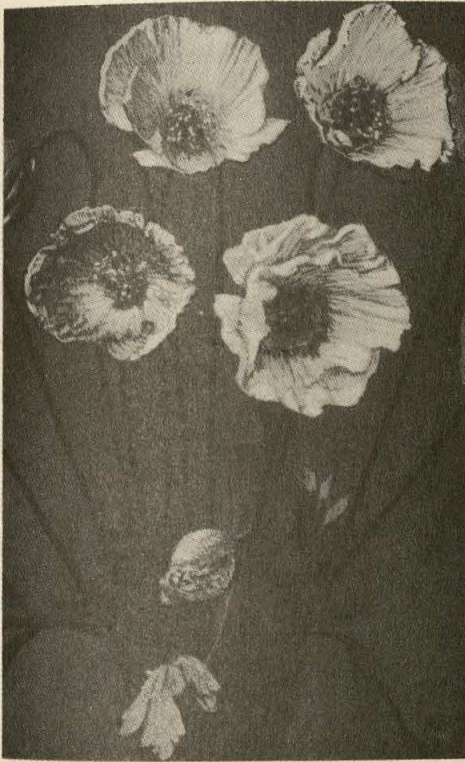
POP'LAR. The faintest breath of air seems to stir the leaves of the poplar trees into action. These fast-growing trees are often planted along roads and streets and are found growing wild throughout both lowlands and mountain country. Poplars are thirsty trees and usually indicate water near by.

The bark of the tree is grayish or brown in color; the wood is light and brittle. Poplars have heart-shaped leaves, with a light green upper surface and a silvery underside. Like the willows, poplars bear their yellowish-red flowers in catkins. These later split open, releasing a cloud of tiny down-covered seeds which blow for great distances, sometimes taking root miles away. Even a twig from a poplar often will take root. Though sometimes used for packing cases, poplar wood is brittle; it is a valuable source of wood pulp.

Among the outstanding trees of the poplar genus are the *Lombardy* poplar, the *cottonwood*, the *white* poplar, the *quaking aspens*, and the *balsam* poplar.

POP'PY. Long recognized by poets and artists as the symbol of death and sleep, the poppy is famed both for its beauty and as a source of opium. There are more than 100 species, including annuals, biennials, and perennials, some tall and gorgeous, others dwarfed and silky.

Poppies bear beautiful green leaves and brilliant flowers varying from deep red to white. The blossoms shatter easily but are quickly replaced by others. Because of the abundance of poppies found in Flanders during World War I, they have been adopted as the Memorial Day flower of war veterans. The showiest of the poppies is the *Oriental* species, which has brilliant red, orange, or salmon-colored blossoms. The *Iceland* poppy is small but hardy. Blossoms of the *opium* poppy vary from white



FLOWERS OF THE FLAME

Flamboyant in scarlet and orange, bright poppies dot field and garden with points of fire.

to red; the plant produces an oil as well as opium. *Shirley* poppies, daintiest of the annuals, are crinkly, silky flowers of delicate reds and pinks. Belgium's national flower is the colorful corn poppy. The *California*, or *golden*, poppy is the official flower of the state whose name it bears. Both grow wild in profusion. See **OPIUM**.

POPULATION. All the inhabitants of an area, taken together, make up its population. Although it is impossible to know the exact number of men, women, and children alive at any one time, the earth's population was estimated at considerably less than a billion in 1800. Today it is some 2,850,000,000 and is increasing by about 60,000 daily.

Among the many causes for this remarkable increase are the rapid advances that have been made in medical science, economic conditions, and methods of produc-

ing and distributing food and the other necessities of life. In all the highly civilized nations, fewer persons now die in infancy than they did only a century ago, and the life span continues to lengthen. Thus the average number of years a person in such a country may expect to live is greater than ever before.

The United States, for example, had a population of only 3,929,214 in 1790, when its first *census* was taken. But this number has now increased to about 179,500,000. Moreover, the life expectancy of its people has increased from about twenty-seven years in Washington's time to nearly seventy years today—a figure doctors say can be raised to well over 100.

Yet the numerous floods, famines, epidemics, wars, and other catastrophes of history have resulted in many sharp population decreases. In some countries, including many of western Europe, the present-day tendency toward a declining birth rate also plays a part in keeping down populations. In others, the birth rate is rapidly rising, Japan and India being examples. In any case, the earth's population continues to grow rapidly, and even world wars, with their enormous losses of life, merely check its rate of increase.

Sex. Throughout the world, more boys than girls are born, but men die earlier than women from natural causes, and also in greater numbers during wars. Thus the earth's females outnumber its males, especially in many European countries. This also became true in the United States between 1940 and 1950, as the census for the latter year showed for the first time. For every 100 females, that country now has only 98.1 males. Nevertheless, there are some lands where boys are so much more highly regarded and better cared for that their males outnumber their females.

Population Shifts. Of course, the large numbers of immigrants who have poured into the United States, Canada, Australia, New Zealand, South Africa, and some of the other lands opened up in modern times account for a large part of their population

increases. Naturally, too, the loss of inhabitants to such countries has resulted in drastic population decreases in some nations, as Ireland proves.

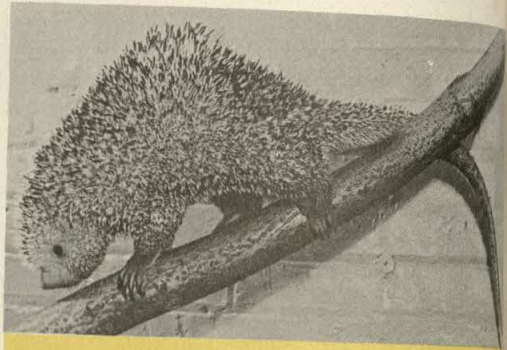
In its early days, a nation has more people living in its rural districts than in its cities. But as its means of communication and its industrialization are extended, more and more of its people move cityward. In 1880 less than 30 per cent of the United States' population lived in communities of over 2,500, but some 67 per cent is now urban. Both Canada and the United States have also experienced a steady westward movement of their peoples. In the United States the center of population was some twenty-three miles east of Baltimore, Md., in 1790. By 1960 it had moved to about eight miles northwest of Clinton County, Ill. See CENSUS.

POPULIST PARTY, or PEOPLE'S PARTY. See POLITICAL PARTIES IN THE UNITED STATES.

PORCELAIN, por'se lin. China, home of fine pottery, is the birthplace of porcelain, also called *china* and *chinaware*. Porcelain is a hard and translucent earthenware which some writers claim was first made as early as the third century, B. C. Most authorities, however, place its beginnings at a later date, possibly the fourteenth century.

Porcelain was introduced into Europe in the latter years of the fifteenth century, but Italian and French pottery makers, who studied the art, were unable to duplicate the Chinese *hard-paste* porcelain. Instead, they manufactured an artificial *soft-paste* variety made of gypsum, sand, sea salt, and other materials. In the early eighteenth century, however, Johann Böttger, who lived near Dresden, discovered the secret, and made a hard-paste porcelain by firing kaolin and feldspar.

The commercial porcelain of today is mostly a natural soft-paste, or *bone*, china, made of natural clays and bone dust. It finds use as tableware, in the manufacture of artificial teeth, dental crowns, spark plugs, and as a coating for plumbing fixtures. See POTTERY.



MOBILE CACTUS

Thorny, quilled South American porcupine.
Chicago Park District

PORCUPINE, por'ku pine. When another animal attacks a porcupine in the forest, there is little doubt as to who will win the fight. For the porcupine, though small, has a unique but wholly adequate means of defending himself.

The porcupine has an awkward waddling gait and is a stupid, though far from harmless, creature. His back is covered with stiff, sharp spines that are well mixed with the long coarse hair. Normally, such quills lie flat on his back, but when the animal is attacked they are raised to an upright position, as he forms his body into a bristling, unconquerable ball. If another animal is foolhardy enough to "slap" a porcupine, this "walking pincushion" usually leaves his molester with the sharp quills embedded in the flesh. They cause painful sores and often result in death. The porcupine cannot "throw" his quills.

The Old World porcupine is a cave-dwelling rodent and hibernates in the winter in much the same manner as the bear. North American porcupines are yellowish or black in color and spend much of their time in trees. They feed principally on bark, twigs, and plants. The young grow rapidly and soon take up the solitary life so typical of porcupines. See HEDGEHOG.

POR'GY, or POR'GEE. In the Atlantic Ocean and the Mediterranean and Red seas are found a number of fish with high, narrow heads and with high-placed eyes. These

are porgies. The members of the group feed upon other fishes, and most of them are considered good fishes by man. Some members of the family have heads which look like that of a sheep, and are called *sheeps-heads*.

PORK. Every year millions of hogs are shipped to the various packing plants in the United States to be converted into pork. For, in America, pork is a valued and popular meat, and a great many products are derived from it. Pale in color, pork should be firm and fine-grained. It should always be thoroughly cooked, as the flesh of the hog is often infested with parasites.

For further information, consult the following titles:

Bacon	Meat
Ham	Meat Packing
Lard	Sausage

PORPOISE, *por'pus*. Observed with interest by passengers on ocean-going vessels, the porpoise looks and acts very much like a fish, but has warm blood and suckles its young as other mammals do. Porpoises, dolphins, grampuses, narwhals, and white whales all belong to the same group. Of these, the dolphin is interesting because of its long snout, and the narwhal because of the long tusk at the end of its head. The white whale has no fins on its back, and the grampus has a very high back fin, but no teeth on its upper jaw. Porpoises have rounded heads with no snout or beak, and triangular fins in the middle of the back.

The porpoises are most commonly seen swimming together in schools, and apparently enjoy tumbling along on the surface, puffing like pigs as they pursue the fish which they eat. Porpoises are about five or six feet long. They are bluish black above and white beneath. Their skins are smooth, their mouths are large, and both jaws are well armed with teeth. Their flesh yields oil and their hide is used in making leather.

PORTER, DAVID DIXON (1813-1891). During the Civil War, valuable aid was given the Northern cause by the leadership and ability of David Dixon Porter, an out-

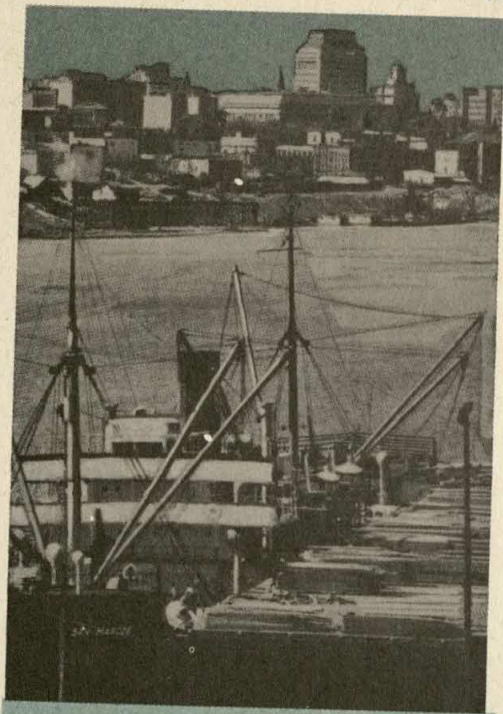
standing naval commander in American history. He was the son of Commodore David Porter, and entered the service of the United States Navy as a midshipman in 1829. He performed brilliantly as a lieutenant in the Mexican War, commanding the *Spitfire*. When the Civil War broke out, Porter was given command of the steam frigate *Powhatan*, and his services in the capture of New Orleans brought him a promotion to the rank of commander.

He assisted Grant in the capture of Vicksburg, a service which further advanced him to the post of rear admiral. While with a blockade squadron in 1865, he helped in the capture of Fort Fisher. Following the war, he was appointed head of the Naval Academy at Annapolis. Porter became vice admiral in 1866, and upon Farragut's death in 1870 was elevated to the rank of admiral.

PORTER, WILLIAM SYDNEY (1862-1910). Color, movement, vigor—all the triumphs and heartaches of the common people—are contained in the short stories of O. Henry, whose real name was William Sydney Porter.

He was born in Greensboro, N. C., but in 1884 he went to Texas where, for two years, he worked on a ranch. Later, he held a position in the General Land Office in Austin, Tex., and, after his marriage, in 1887, Porter obtained a job for a time as teller in the First National Bank in Austin. While employed by the *Houston Post*, in 1896, he was indicted for a theft which occurred when he had worked in the bank, and in 1898 he was sentenced to the Ohio State Penitentiary, although his guilt is still disputed.

While in prison, Porter perfected his unique style of short-story writing, and upon his release, in 1901, he went to New York, where he had a ready market for his talents. His stories of New York life won the greatest attention, but critics believe that those of the Southwest have more lasting merit. Some of his best-known volumes include *The Four Million*, *The*



LUMBER PORT OF THE PACIFIC

A hundred miles up the Columbia, Portland carries on deep-sea commerce, ships more lumber than any other United States port.

Voice of the City, The Trimmed Lamp, and Cabbages and Kings.

PORTLAND, ORE. Along both banks of the Willamette River, near where it empties into the mighty Columbia, stands Portland, Oregon's largest city and one of the Pacific Northwest's greatest transportation, distributing, and industrial centers. Its excellent fresh-water harbor, lying inland from the Pacific only about 100 miles, is easily reached by ocean vessels. It is also an important railway, airline, and paved-highway hub.

Surrounding the city is a rich agricultural and timber region, and nearby is the Columbia's electricity-generating Bonneville Dam, which helps to make the area an important shipbuilding and manufacturing center. Portland ships more lumber and wheat than any other United States port, and its industrial products include lumber, furniture, paper, pulp,

flour, feeds, cereals, canned fruits and vegetables, meats, textiles, clothing, metals, and metal products.

"The City of Roses" is noted for its cool summers, mild winters, flowers, gardens, and world-famous Rose Festival, which attracts thousands of visitors each June. Here, too, are the medical and dental schools of the University of Oregon, Portland University, several fine colleges, and an excellent art museum.

Mounts Hood, Saint Helens, and Adams are among the handsome snow-capped peaks of the Cascade and Coast ranges providing a beautiful background for the city. The snow fields and Timberline Lodge on Mt. Hood are easily reached by an excellent motor road, and the scenic Columbia River Highway runs out from the city.

Portland was founded in 1845 by Francis Pettygrove, of Maine, and Amos Lovejoy, of Massachusetts, who flipped a coin to decide whether it should be called Portland, Pettygrove's preference, or Boston, as Lovejoy wanted. Chartered in 1851, it has grown rapidly and now has a population of about 374,000.

PORTO RICO. See PUERTO RICO.

PORTUGAL. Though smaller than Indiana, this European nation was a great power in the fifteenth and sixteenth centuries. Its daring seamen not only rounded Africa and found the sea routes to Asia, but its sons also discovered and colonized Brazil, whose language and traditions are still Portuguese.

Even with the Azores and Madeira islands, which are governed as parts of the mainland, Portugal covers about 35,400 square miles and has only about 8,950,000 inhabitants. But the combined area of its overseas provinces is over 800,000 square miles, or some twenty-three times larger. These are: Principe, San Tomé, and the Cape Verde islands, off Africa; Angola, Portuguese Guinea, and Mozambique, in Africa; Goa and other small settlements, in India; Macao, on China's coast; and part of Timor Island, one of the Malay



Top, courtesy Thomas Cook & Son

HOME PORT OF DISCOVERERS

From Lisbon sailed tiny craft which showed the way to India, the Isles of Spice, the rivers of Brazil. Top, the capital, on the banks of the Tagus River. Below, the Tower of Belem.

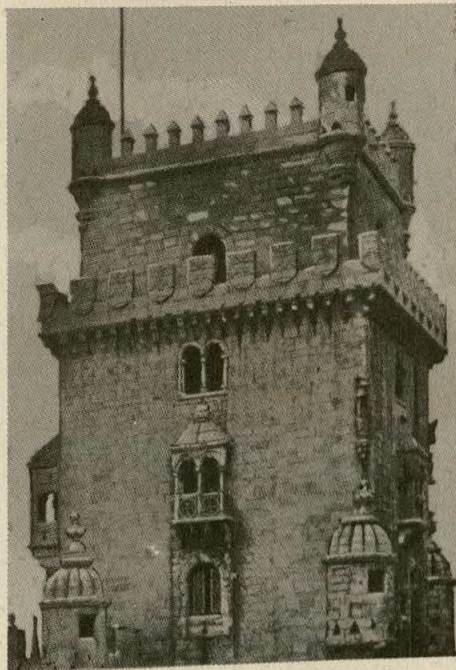
islands, northwest of Australia.

Occupying the southwestern portion of the Iberian Peninsula, Portugal is bounded on the south and west by the Atlantic; on its other sides by Spain. It is closely bound to its only neighbor racially and culturally, and Portuguese, its national language, is similar to Spanish. Yet the smaller country is traditionally allied with Britain and the West both politically and commercially. During World War I it joined the Allies; in World War II it was neutral, but allowed Britain and the United States to establish air bases on the Azores. See **WORLD WAR (I, II)**.

The Land. Portugal is largely mountainous, its highest range being the Serra da Estrella, whose tallest peak rises 6,532 feet above sea level. Yet the interior contains many valleys, and parts of its long coast are low, though other sections are high and rocky. Best of its ports are Lisbon, its largest city and capital, on the Tagus estuary, and Oporto, near the mouth of the Douro. A third important river is the Guadiana, which forms part of the Portuguese-Spanish border.

Climate. Portugal's deep southern valleys are very hot and dry in summer. Most of the country, however, has a mild, Mediterranean climate and very heavy rainfall.

Resources and Industries. Despite Por-



tugal's rough surface and old-fashioned farming methods, agriculture is its chief industry. Its terraced, northern vineyards grow the grapes for making its famous port wine, which is named for Oporto. Farther south, eating and raisin grapes are raised. Other chief crops include rice and other cereals, olives, oranges, lemons, figs, almonds, and walnuts. Great numbers of cattle, oxen, mules, sheep, goats, and hogs also are raised.

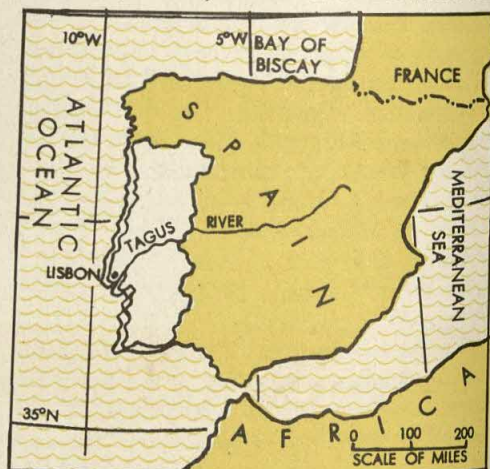
The bark from Portugal's many forest and cultivated cork-oak trees provides much of the world's cork. From its ex-



By Deane Dickason from Ewing Galloway; by Ewing Galloway, N.Y.

PICTURESQUE PORTUGAL

At top, a maiden of Madeira. Above, the capital city of Lisbon. At right, location map of Portugal.



tensive forests also come resin, turpentine, and shipbuilding timbers. But ocean fishing, especially for sardines, tuna, and cod, is next in importance to grape growing.

Since the start of World War II, tungsten mining has rapidly increased. Otherwise, Portugal has only begun to exploit its mineral wealth, which includes copper, iron, lead, tin, sulphur, kaolin, coal, and uranium.

Manufacturing also is in its infancy, although a program for building hydroelectric plants, encouraging industrial development, and improving the nation's transport has been adopted. Wine, olive oil, cork and tobacco products, textiles, and porcelain tiles, pottery, laces, and Madeira

embroideries are the chief manufactures.

Transportation. Lisbon is a great international air center, but Portugal has so few railroads and paved highways that much of its commerce is carried by river and coastal vessels. Its rural roads are poor; muleback and oxcart travel is still common.

People. Most of the stocky, swarthy, hard-working Portuguese earn a meager living from farming and fishing. Primary education is compulsory, but the illiteracy rate remains high. Besides famous Coimbra, founded in 1290, there are universities at Lisbon and Oporto. Roman Catholicism is the religion of most of the people.

History and Government. Portugal was first settled by Phoenicians and Carthaginians, later conquered by the Greeks, Romans, Goths, and Moors. Between the

1100's and the mid-1500's it pioneered in discovering new lands and trade routes and built up an extensive empire. But Spain controlled Portugal from 1580 to 1640, and Napoleon's French troops occupied it from 1792 until 1811. A revolution drove the Portuguese king into exile in 1910, and next year Portugal became a republic. Numerous uprisings then occurred until 1928, when Antonio Salazar, as Finance Minister, began restoring order. In 1932, as Prime Minister, he took over control of the government.

Portugal is a "corporative" republic, with a President, Cabinet, National Assembly, and Corporative Chamber. Opposition to the government is suppressed. Portugal signed the North Atlantic Treaty in 1949.

Consult the following articles:

Azores	Henry the Navigator
Brazil	Madeira
Cape Verde Islands	Portuguese East Africa
Gama, Vasco da	Spain

PORTUGUESE EAST AFRICA, or MOZAMBIQUE, *mo zam beek'*. This overseas province of Portugal covers nearly 300,000 square miles along Africa's south-eastern coast. It is bordered on the east by an arm of the Indian Ocean, on the north by Tanganyika, on the west by Lake Nyasa, Nyasaland, the Rhodesias, and the Union of South Africa, and on the south by the Union of South Africa. It is crossed by the Zambezi River. The coastal lowland is hot and rainy; the interior, largely mountainous and heavily forested. Nearly all the 6,234,000 people are Bantus.

The chief products are sugar, cotton, sisal, copra, and other tropical crops, corn, and various minerals. Gold, coal, and samarskite are produced, and large deposits of silver, asbestos, and uranium were discovered in 1947. The chief ports, Lourenco Marques, the capital, and Beira,

handle much more export trade for Southern Rhodesia and South Africa than for Mozambique. Discovered by Vasco da Gama in 1498, the region was first colonized by Portugal in 1505.

PORTUGUESE MAN-OF-WAR. A colony of jellyfish attached to a single crested, air-filled bladder, the Portuguese man-of-war is found on the surface of the Atlantic, especially its warmer waters. The long tentacles, which hang down into the water to catch fish and other food for the colony, contain a poison that makes their sting very painful. When a "fleet" of colonies is blown close to shore, public beaches may be closed.

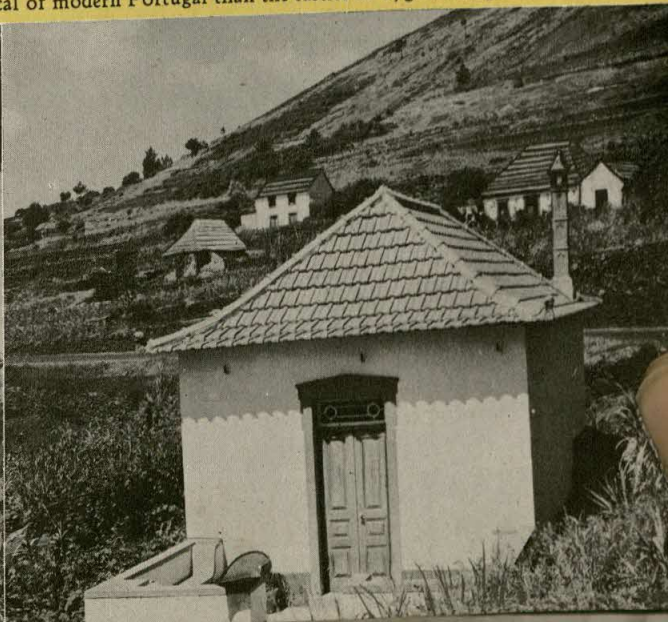
POSTAGE STAMPS. A postage stamp is a small, gummed printed paper that is attached to mailed matter to show that the charge for carrying it has been paid. Before it came into use, postage was usually collected from the person receiving the mail. Rowland Hill, England's Postmaster General, invented the postage stamp in 1840. Costing one penny (two cents), it carried a letter to any part of England and was so successful that other countries soon adopted stamps.

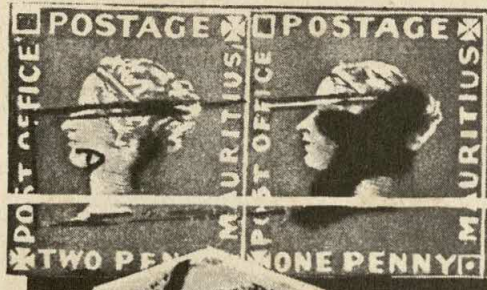
Up to 1845, stamps on letters were unknown in the United States. If the sender prepaid the postage, the postmaster endorsed the payment upon the letter in the

By Burton Holmes from Ewing Galloway

LAND OF MOORISH CASTLES AND TINY COTTAGES

The clean little farmhouses are more typical of modern Portugal than the castles of bygone kings.





THESE ARE TREASURE TROVE TO THE PHILATELIST

(1) A misprint made these Mauritius stamps worth \$25,000. (2) Most prized stamp in the world, valued at \$50,000. (3) Valuable Confederate Postmaster cover. (4) \$7,500 unused Millbury. (5) One of the earliest British, 1d. (6) Cochin Maharajah. (7) Sudan postage. (8) Historical type, Costa Rica. (9) China. (10) Australian Kookaburra and (12) Swan—animal types. (11) United States, Columbus. (13) Canada, Coronation. (14) Polish, air mail. (15) United States, Mayflower. (16) Cape of Good Hope, triangle. (17) Bamra, native type-set stamp.

(1-4) Courtesy Popular Mechanics

POSTAL SAVINGS BANKS

upper right-hand corner; if it was not prepaid, the absence of such endorsement signified the fact, and the postage had to be paid by the person receiving the letter.

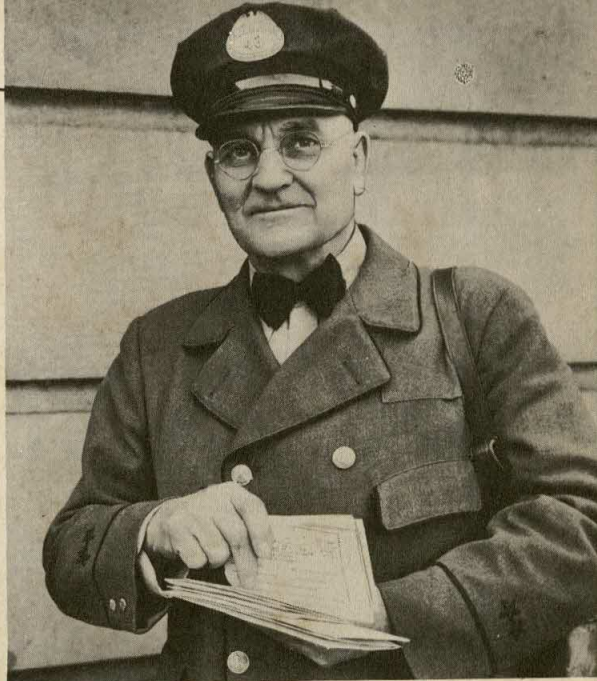
In cities, endorsement of postage prepayment became a burden, and the government permitted postmasters at their own expense to issue stamps to be affixed to prepaid letters; about a dozen postmasters took advantage of this privilege. After two years the Post Office Department was convinced that stamps had been proved economical, and in 1847 all private privileges were withdrawn, and the government issue of postage stamps was begun. Until 1856, however, prepayment of postage was not required by law.

Early issues of stamps were not perforated; a sheet contained from 100 to 200 stamps, printed closely together, and it was necessary to cut them apart. See **POST OFFICE DEPARTMENT.**

POSTAL SAVINGS BANKS. See **SAVINGS BANKS.**

POSTAL UNION, UNIVERSAL. Among the most effective international agencies ever established is the Universal Postal Union, also called the International Postal Union. It was founded in 1874 at Bern, Switzerland, the present headquarters. Its purpose is to maintain uniform postal regulations and postal rates between nations, and to facilitate handling of the mails. A congress of delegates from member nations, embracing the civilized world, meets every five years to discuss ways of improving the postal service. Between meetings, the organization's affairs are handled by a nineteen-member committee appointed by the United Nations, of which the Union became a specialized agency in 1947. The first organization of the kind was formed among the German states and served as a model for the present one.

Under the Postal Union of the Americas and Spain, created in 1920, letters can be sent by ordinary mail from the United States at the rates in effect within the United States. Air and other mail rates vary, however.

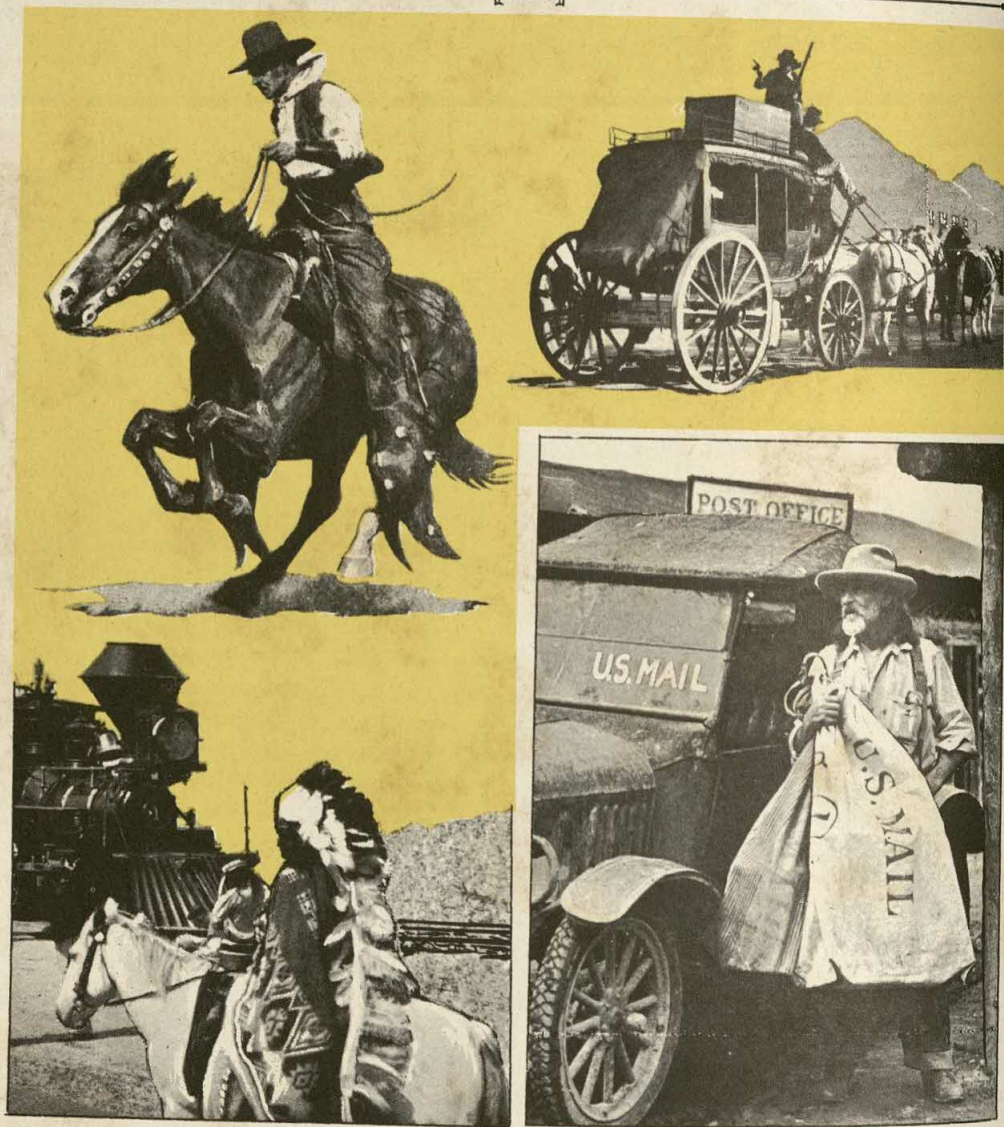


U.S. Post Office Dept. Photo

POST OFFICE DEPARTMENT. Every day, except Sundays and holidays, mail is delivered to people throughout the United States. It is a tremendous task, but one of the most efficient services carried on by the Federal government. This service is under the direction of the Post Office Department. The United States Postal Service has developed into the largest business in the world with about 36,000 post offices and hundreds of thousands of employees. The system handles billions of dollars annually, has more than one million and a half miles of post routes, and issues billions of stamps yearly. The Postmaster General, head of the service, is a member of the President's Cabinet.

Income is obtained only through postage — by stamps, mail contracts, meters, etc. Very seldom do the receipts equal the expenditures, which cover salaries, transporting the mails, and the upkeep of the numerous post offices. The deficit is provided for by special appropriations of Congress.

Postage Stamps and Service. Stamps of various denominations up to five dollars are issued by the Post Office. The same rates prevail for sending ordinary mail to Canada and Mexico as within the United



PIONEER GROWTH

The American mail system developed and expanded as settlers moved West. Above, left, the pony express rider crosses the plains; right, a mail stagecoach. Lower, left, transcontinental trains carried mail; right, early automobiles for rural door-to-door delivery.

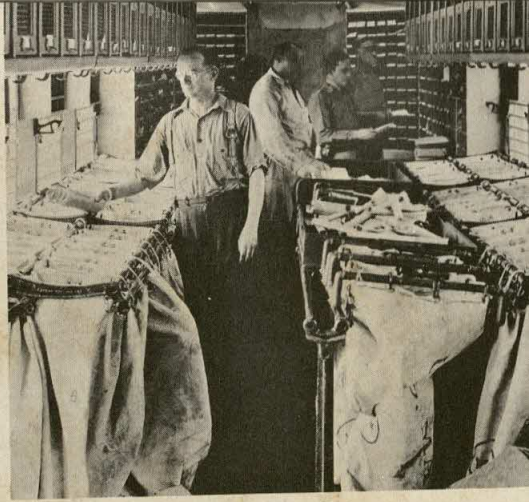
States. Post cards may be mailed within the United States for three cents; to foreign countries the rate is five cents. The mailing of ordinary letters within the United States costs four cents per ounce or fraction of an ounce. Ordinary letters to foreign countries cost eight cents for the first ounce, and five cents for each

additional ounce.

Post cards may be airmailed for five cents within the United States, and to foreign countries for ten cents. Ordinary letters may be airmailed within the United States for seven cents per ounce. The mailing of an air letter sheet to a foreign country costs ten cents. Otherwise airmail



United Air Lines



U.S. Post Office Dept.

MAILMEN AND MACHINES

Above, left, modern successors to the Pony Express are airplanes and, right, mail railway cars. Automated post offices have electronic-mechanical machines to automatically sort mail, and facsimile transmission for "instant" mail from coast to coast has been demonstrated.

rates to foreign countries vary. The charge for special delivery of first class mail weighing under two pounds within the United States and Postal Union countries is thirty cents. There are also charges for registered, insured, and certified mail.

There are four classes of mail with different rates for each class. All ordinary written matter is first class. Periodicals, advertising, circulars, and packages fall into the other three classes.

Packages weighing from one to seventy pounds may go by parcel post, and from eight ounces to seventy pounds, by air parcel post. Parcel post is fourth class mail. Rates vary according to eight zones. The first zone is within fifty miles of the sending post office. The eighth is more than 1,800 miles away. Mail under a pound is charged as a full pound. Parcel post may go by air-mail to foreign countries.

Post offices in the United States are divided into four classes according to the amount of their annual receipts. Postmasters are Civil Service employees.

What Happens to a Letter. After letters are dropped into the mailbox, they are picked up by a collector and taken to a post office where the stamps are canceled. The letters are then sorted and placed in bags according to their general destination

and are taken to the train or plane on which they are to travel. On the train is a railway post office, consisting of one or more cars equipped for the sorting of mail by special clerks as they are traveling. Buses, with similar equipment, also are used as "traveling post offices," especially in areas lacking rail service. Dropped at its destination, the mail is re-sorted in local post offices according to addresses and is then delivered or picked up. Special machines and devices have been developed for rapidly canceling and counting letters, for catching and dropping mail from moving trains, and for speeding up service in various other ways.

History. The first postal service in the United States began in Boston in 1639 for overseas mail. In 1691 the British government granted a patent to Thomas Neale under which he could set up post offices in the American colonies. In 1707 the government took over his rights. Benjamin Franklin became postmaster for Philadelphia in 1737, and was made Co-Deputy Postmaster General of the British Colonies in America in 1753. He became Postmaster General under the Continental Congress in 1775. In 1789 the Constitution gave Congress the right to establish "post offices and post roads," and

a law provided for a Postmaster General. But he did not become a Cabinet member until 1829, and his office did not become an executive department until 1872.

The government issued its first postage stamps in 1847. In 1860-61 the Pony Express was the pride of the West. Free-delivery, money-order, special-delivery, and parcel-post systems have followed. So, too, have traveling post offices—aboard ships as well as land carriers—and many other means of expanding and improving service and personnel.

Also consult the following articles:

Parcel Post	Postage Stamps
Pony Express	Postal Union, Universal

POT'ASH. Soils containing potash encourage the growth of starchy plants and make them resistant to disease. Chemically, potash is potassium carbonate, a compound of carbon, potassium, and oxygen. It is an important ingredient in fertilizers, and is used in the manufacture of glass and soap. See POTASSIUM.

POTASSIUM. A very active chemical element, potassium never occurs free in nature. It is a silvery, soft, light metal of the alkali group which tarnishes quickly in air and reacts explosively with water.

Potassium is one of the essential elements for plant and animal growth. It is necessary in plants for the manufacture of carbohydrates, to form a suitable alkaline medium for the action of those enzymes which put starch into a form capable of being carried through the plant for the production of cellulose; it is essential for good leaf development; for a good yield of sugary and starchy crops like beets and potatoes; and for the neutralization of the acid waste products of life which, if they were not neutralized, would hinder growth.

Formerly, Germany had a monopoly on potassium fertilizers, since it owned the largest deposit of potassium salts; but during World War I, hitherto neglected American sources were profitably worked. Such sources are lake deposits of the West, kelp (a seaweed), alunite, leucite, cement-

mill dust, blast-furnace dust, beet-sugar waste, molasses residues, green sands of New Jersey, and wood ashes.

Common potassium compounds are the hydroxide, or caustic potash; the carbonate, or commercial potash (see POTASH); the chlorate, used in making explosives; the nitrate, or saltpeter (see SALTPETER), used as a medicine and in making gunpowder; the permanganate, used in medicine as an antiseptic, and in chemistry as a catalyst, an indicator, and an oxidizing agent; the cyanide, a deadly poison, used in photography and as a reducing agent; the sulphate, used as a chemical reagent; and the acid tartrate, used in making baking powder. The chemical symbol of the element is *K*.

POTA'TO. The common Irish potato, without which no dinner seems to be complete, is actually not a native of Ireland at all, but is one of the gifts of the American Indian to civilization. Early Spanish explorers found potatoes growing in Ecuador in the sixteenth century, and the vegetables were brought to the Atlantic coast of North America. The first potatoes to be raised in Europe were those which were brought from America by one of Sir Walter Raleigh's expeditions, about 1586. They were raised on Raleigh's Irish estate near Cork, and later saved the people of Ireland from starvation during periods of crop failure. Late in the eighteenth century, both Germany and France began the extensive cultivation of this valuable crop, now a staple plant food in Europe and the American continents.

Potatoes are members of the nightshade family, which includes also the tomato, the tobacco, and the eggplant. The edible portions, or tubers, are produced by bushy plants which often grow to a height of two feet and are characterized by dark-green, irregular, slightly hairy leaves. The tubers are borne at the end of leafless, underground shoots. These tubers are formed by the storing of large amounts of starch at the end of the underground stems. The "eyes" of the tubers are leaf buds. Just



before the tubers begin to develop, the plant puts forth white blossoms, which later fall off. Only the wild species of potato produces a seed pod.

Potatoes are generally planted in furrows at a depth of approximately four inches, to prevent "sun-burning" the young tubers. Seeds are not planted, but a full-sized potato is cut into sections, each of which must have an "eye," from which the young plant sprouts. The fleshy part of the cutting feeds the young plant until it becomes rooted. Potatoes do best where the climate is moist and cool, and in fertile, sandy loam soils. The crop is not dug until the vines are completely dead. New potatoes are merely immature ones that have a thin peel.

All types of potatoes are rich in starch and the greatest food value lies next to the skin; baked potatoes are therefore the most nutritious. The annual crop in the United States often exceeds 425,000,000 bushels. Potatoes are raised in every state, the chief producers including Maine, Idaho, California, New York, and North Dakota. Russia, Germany, and Poland are even greater producers. Breads are made from potato flour, and the tubers are often fed to stock. They are also used in making starch and an alcohol used to power motors and engines. See BURBANK, LUTHER.

International Harvester Co.

GOOD-BY TO GRUBBING

With a tractor-drawn digger, the harvesting of potatoes can be performed with speed and efficiency.

POTATO BUG, or COLORADO BEETLE. This insect, of the Rocky Mountain region, feeds on potato vines in practically every part of the United States and in every province of Canada.

In the fall the adult beetles enter the ground and there hibernate until the warm days of spring, when they come out from their winter quarters. They are stout beetles nearly half an inch long, generally yellowish in color, with five black lines running lengthwise on each wing cover. As soon as the potato plants appear, the female beetles begin laying their yellowish eggs in masses on the undersides of the leaves. In about a week the eggs hatch, and the hungry, yellow-orange larvae devour the plants and increase in size very rapidly. Poison sprays and dusts are used to control the pests.

POTAWATOMI, *pot ta wah't'o mi*. The Potawatomi Indians lived near the shores of Lake Michigan in the days when white men first began to explore the region. They

GENESIS OF PERFECTION

From a lowly lump of moistened clay the deft fingers of the potter fashion a vase which, decorated, may become a museum piece.



lived in the vicinity of Green Bay at first, then on the site of Chicago, and, after driving out the Illinois tribes, spread around the lower tip of the lake into what is now Michigan. About 1,600 Potawatomis now live in Wisconsin, Michigan, and Kansas, about 1,100 of them being found in the latter state alone.

POTOMAC RIVER. Perhaps more than any other river in the United States the Potomac holds the affection of all Americans. Along its shores are shrines which every child hopes sometimes to visit; and all patriotic Americans long to make a pilgrimage to Washington, capital of the nation, and to Mount Vernon, home of George Washington, perfect in its peerless setting, high on the bluff overlooking the river.

Two small streams in the Alleghenies unite to form the Potomac, which winds its way between Maryland on the left and West Virginia and Virginia on the right, past Harper's Ferry where the Shenandoah River enters, moving swiftly along until it tumbles over picturesque Great Falls just above Washington. It then spreads out in a broad, smooth expanse to meet the pulse of the tides which push in from Chesapeake Bay and the Atlantic for 125 miles. The river is navigable for large vessels from Washington to the mouth, and in colonial days the tobacco of the rich Virginia plantations was loaded on sailing vessels at the prosperous little city of Alexandria and carried to England.

POT'TERY. In a broad sense, any ware made of burned clay is pottery, but in the United States the name has often a narrower significance, meaning a particular kind of earthenware used for decorative purposes. Of this ware, vases, bowls, candlesticks, and other objects are made in beautiful shapes and attractive colors.

How Pottery Is Made. Good pottery can be made from almost any kind of clay. Dark-colored wares are made of dark-burning clays, and lighter-colored wares of finer white clays, which must be mixed.

Vases are either made on the potter's wheel, or in molds by the process of casting. Clay used for shaping a piece on the wheel must be in the plastic state; that is, it must be mixed with just the right amount of water to make it capable of being easily shaped into any desired form and of retaining that form. The piece is shaped by the hands of the worker from a ball of clay placed on the wheel head as it revolves. The shaping process is called *throwing*. The piece may be finished by being turned with metal tools in a lathe somewhat like that used for wood turning.

In the larger factories, vases are more often made by casting. The molds used for casting are made of plaster of Paris, which absorbs water very readily; and the clay is used in the liquid form called *slip*, about the consistency of cream. When the dry molds are filled with slip, the plaster quickly takes up the water from the clay next to it, and a



Glazed Assyrian Jar



Modern Glaze Vase



*Ancient
Peruvian
Vessel*



*Famille Noir
Vase, reign of
K'ang Hsi*



*Figured Vase,
Ancient Greece*

POTTERY—*Born with the Primitives*

Finding of a lovely vase, adorned with panels of landscapes and hunting scenes along the Tigris River, in one of the lower layers of Tepe Gawra has further emphasized the fact that, of all man's arts, pottery is the oldest and most universal.

It is known the Egyptians were using the potter's wheel 4,000 years before the Christian Era, and established Chinese records tell of pottery making over 4,500 years ago. Certain it is that one of the first things men learned to do was to shape clay into eating and drinking vessels and to fire them. Decorating and glazing the vessels followed.

China particularly refined pottery art until, during the Han period, she produced the exquisite jars and snuff bottles that were to influence the makers of fine Renaissance porcelains. From China the art passed to Korea and Japan in the seventh century.

Near the Mediterranean, Assyrian, Egyptian, Phoenician, and Rhodian potteries flowed into the beautiful Greek vases of the eighth to third centuries B. C., famed for their decorative figures. The Romans carried on fine pottery traditions.

In the Renaissance, nearly all countries of Europe developed notable potteries, of which just a few were the blue Majolica and the Della Robbia of Italy, the Delftware of Holland, the Sèvres of France, and the Wedgwood and Spode of England.

Native American wares, of course, began with the ancient tribes of Mexico, Central America, and Peru. Some of these motifs are quite similar to modern Indian ware. Today, most of the best American potters work in their own small studios.



INDUSTRY AND ART COMBINED

(1) The Japanese potter follows a craft known to his people hundreds of years before Europe learned it. (2) The English Willow pattern. (3 and 4) Glazing and firing modern pottery.

wall of clay is deposited over the inside of the mold. When this is thick enough, the rest of the slip is poured out. The piece soon hardens so that it can be lifted out.

Pieces with raised decorations are often made by casting. Cast pottery can always be identified by the fact that, in a cast piece, where there is a raised form on the outside there is a corresponding depression on the inside. Some kinds of pieces are made by pressing plastic clay into plaster molds. Others, such as deep vases or flaring bowls, are made over molds on machines known as *jiggers* and *jollies*, which are modifications of the potter's wheel. In a few cases, factory workers build up pieces by hand, just as the Indians do.

Some forms of decoration, such as mod-

eled figures, designs painted in colored slips, and carved or incised (cut-in) decorations, are put on the piece before it has had time to dry.

After the work in the clay is finished, the piece is dried, placed in a *sagger*, or fire-clay box, and fired. It is then called *biscuit ware*, and, being earthenware, must be covered with the hard, glassy coating called *glaze* before it will hold water without seeping. Sometimes designs are painted on the biscuit ware before the glaze is applied.

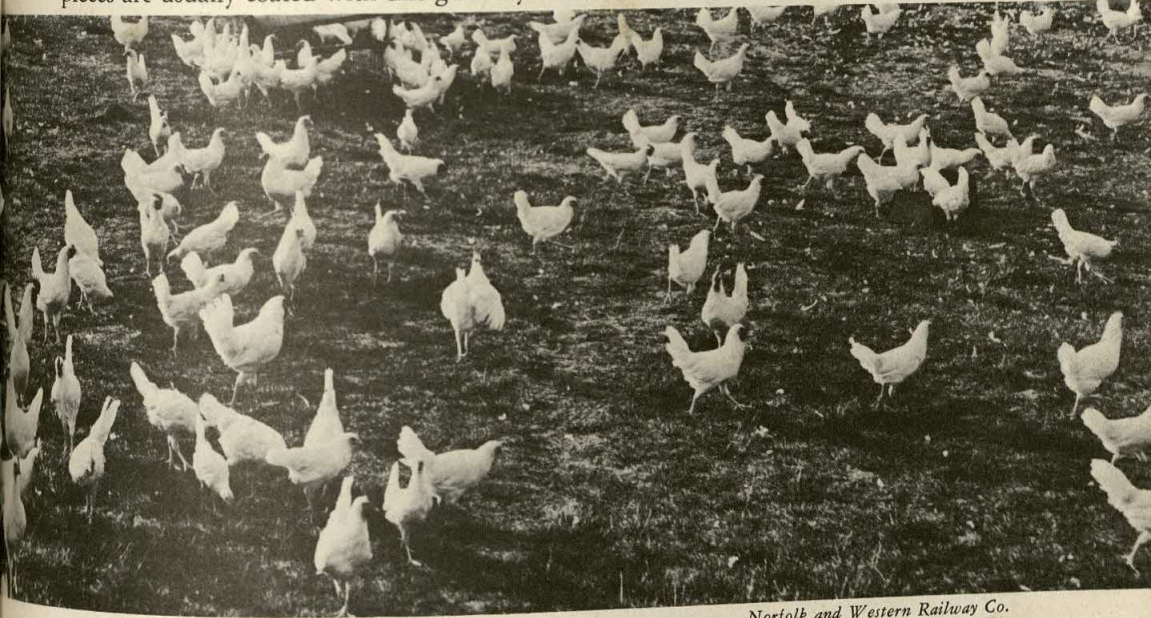
There are two general types of glaze used on pottery, *bright glaze* and *mat glaze*. Bright glazes have a smooth, shiny surface. Some are transparent like window glass, some are opaque. The clear, bright glazes are used where there are colored designs on

the clay; the opaque ones are used in various colors on undecorated pieces. Mat glazes have a dull surface. They are of very recent origin, having been used first in the latter part of the nineteenth century; and most extensively in the United States. Mat glazes are used on undecorated pieces and on those having raised decorations. For the decoration called *glaze inlay*, the body of the piece is covered with a mat glaze and the design is painted in with mat glazes of harmonizing colors. Colorless glazes, halfway between bright and mat in quality, are sometimes put over colored designs to give a beautiful, misty appearance.

Any kind of glaze is prepared by mixing the powdered ingredients with water. The pieces are usually coated with this glaze by

being dipped in large vessels of the mixture. For especially fine ware, the glaze is sprayed on. After glazing, the piece is again fired.

Decoration. An undecorated piece of pottery depends for its beauty on its shape, and the color and quality of its glaze. If a decoration is applied, it is for the sole purpose of adding to the beauty and interest. Sometimes naturalistic (that is, natural-looking) flowers, figures, or landscapes are painted, like pictures, on pottery. This is not a good form of decoration. Where such things are used in the best way they are conventionalized; that is, changed and simplified in a formal way to give a beautiful arrangement of shapes and colors which will add interest and variety to the piece. See PORCELAIN.



Norfolk and Western Railway Co.

POULTRY. Chickens, geese, ducks, turkeys, and guineas are classified as poultry; that is, domestic fowl which are used as food. For centuries, practically every farm has had a brood of chickens or a flock of ducks, geese, or turkeys to add to the home food supply and to be marketed for part of the farm income. In small towns and villages, chickens are very often kept to supply fresh eggs and add occasional variety to the meat menu. In more recent years,

however, the growth of large cities has created a great demand for both poultry and eggs, and small plots of ground have been converted into chicken "farms" and poultry "farms," the owners relying entirely on this industry for their income.

In connection with this fairly new enterprise, the raising of "broilers" in battery brooders is an interesting development. The small chickens are moved progressively into larger brooders, until they are ready for

market, but are never permitted to run on the ground. Specially prepared foods are used, containing all of the elements necessary for growth and to prevent disease. The advantage of this method of raising fowl is that large numbers can be matured on a very small space.

Many breeds of the different types of fowl have been developed, aimed at adaptability to various conditions. Among the common breeds of chickens are the Plymouth Rocks, Buff Rocks, White Rocks, Rhode Island Reds, Buff Orpingtons, Cochins, Brahmas, Leghorns, and Minorcas.

The raising of chickens is by far the most important phase of poultry raising in the United States, far surpassing turkey production. Although poultry is raised in all parts of the country, the leading producing states include Iowa, Minnesota, Pennsylvania, California, Illinois, Missouri, Ohio, Texas, and Indiana. The total farm income from the sale of poultry and eggs amounts to several billion dollars yearly in the United States alone.

POUND. Used to measure amounts of various types of commodities, the pound is a unit of weight. Three different forms of this unit are used. The *avoirdupois* pound is the official unit of weight in the English system of weights and measures. It is divided into sixteen ounces, and is equivalent to 7,000 grains. The *troy* pound, equal to 5,760 grains and divided into twelve ounces, is used principally in weighing precious stones and metals. Employed by druggists in compounding medicines, the *apothecaries'* pound has the same weight as the troy pound, but is divided in a different way.

Pound Sterling. This is the highest denomination of money in the English monetary system. It is equal to twenty English shillings and is issued in both paper notes and coins. Originally this unit represented the value of one pound of silver, hence its name. See **SHILLING**; **SOVEREIGN**.

POWER. In mathematics, if we wish to multiply the number 3 by itself two times, we write it 3^3 , a shorter way of saying $3 \times 3 \times 3$, three to the third *power*. Power

is the term given to the product of a quantity, or *root*, multiplied by itself two or more times. For example, 3^4 is equal to 81. The product 81 is called the fourth power of 3, and 3 is the fourth root of 81. The figure written to the upper right of the numeral, indicating to what power it is to be raised, is called an *exponent*. Powers, roots, and exponents have their greatest application in the theory underlying logarithms. See **CUBE ROOT**; **LOGARITHMS**.

The term power also has an application in physics, where it refers to the work which a machine is able to perform in a unit of time. The power of a machine to do this work is commonly expressed in units of horse power (see **HORSE POWER**).

In the C.G.S. (centimeter-gram-second) system, power is expressed in ergs per second, an erg being the work of a force of one dyne moving through a distance of one centimeter.

The unit of power in electricity is the watt, equal to a current of one ampere (one coulomb per second) under a pressure of one volt. A watt is equivalent to 10^7 ergs per second (or one joule per second), and 746 watts equal one horsepower.

POWHATAN, *pow ha tan'* (about 1550-1618). A famous American Indian chief who had many dealings with the early colonists was Powhatan. He ruled over thirty-four tribes whose territory extended from Chesapeake Bay to the Roanoke River and inland for about 200 miles. Powhatan lived near the English settlement of Jamestown and is reputed to have taken as prisoner Captain John Smith, who was freed through the pleas of the chief's daughter, Pocahontas. Pocahontas' marriage to the Englishman, John Rolfe, cemented a lasting friendship between Powhatan and the English. See **POCAHONTAS**.

PRAETOR, *pre'tor*. Next to the consul in authority in ancient Rome was the praetor. Originally, consuls bore the name as an honorary title, but in 367 B. C. an office by that name was created for the performance of judicial duties. It was limited to the patricians. Thirty years later the com-

mon people, or plebeians, were allowed to hold the office, and about a century later the number of praetors was increased to two. Still later, the praetors alternated as judges and governors of provinces, and their number increased to eighteen.

PRAETORIAN, *pre toh'ri an*, GUARD.

Originally formed by Augustus as a body-guard for the emperor, the Praetorian Guard eventually became the real master of the Roman Empire. Under Augustus the Praetorian Guard was composed of nine cohorts, each consisting of a thousand men. Under the later emperors, the number was increased, as was the pay, and the members became more and more powerful. They deposed emperors at will, and men were forced to bribe them to be permitted to stay in power. The Praetorian Guard was abolished by Constantine.

PRAGUE, *prahg*, or PRAHA *prah' ha* (Czech). The capital and largest city of Czechoslovakia, charming old Prague is located on low hills along both banks of the Vltava (Moldau) River. An Elbe tributary, this river gives the city a navigable waterway to the North Sea. Prague is one of Central Europe's chief rail, road, airway, and commercial hubs and also the leading Czech industrial, cultural, and educational center. Among its many manufactures are beet sugar, chemicals, glasswares, textiles, furniture, flour, beer, paper, leather goods, iron, steel, and machinery, including railway cars.

Founded by Germans, probably in the 700's, Prague became the capital of the kingdom of Bohemia. It was ruled by Austria from the 1500's to 1918, and then became the capital of Czechoslovakia. Occupied by the Germans just before the start of World War II, it was finally freed by the Allies some six years later. The war-torn city remained the capital after Czechoslovakia became a Communist Soviet satellite in 1948. The population of Prague is about 978,000.

Prague is famous for its picturesque churches, palaces, universities, and bridges, some of which date back to the Middle

Ages. It also has fine modern buildings and parks. See **BOHEMIA**; **CZECHOSLOVAKIA**.

PRAIRIE, *pra'ri*, or *prar'i*. When the French, who were the first to explore the interior of North America, saw the great expanses of grasslands along the Mississippi, they gave them the French name for meadows. With the exception of a few trees along the low bluffs, these prairie lands have no forests; their surface is either level or gently rolling, and their elevation at most is a few hundred feet above sea level. They extend, in general, from Southern Michigan and Northern Ohio in a widening band over Northern Indiana, all of Illinois and Iowa, Northern Missouri and Kentucky, Southern Wisconsin, and Minnesota.

The prairie region constitutes the most important single farming region of the United States. It produces great crops of wheat, corn, and oats, and from it is supplied much of our livestock. Illinois and Iowa, the two largest prairie states, are likewise the leading corn and swine states.



ON THE ALERT FOR DANGER
This prairie dog of the Great Plains sits near his burrow, ready for instant escape.

PRAIRIE DOG. "Dog" in name only, the rodents known as prairie dogs are among the most abundant and characteristic animals of the plains and mountains, from Western North Dakota and Eastern Montana and the provinces north of them, southward to Texas and westward beyond Prescott, Ariz., and the central part of Utah. They are heavy-bodied, short-legged,

brownish-colored creatures, much larger than any of the ground squirrels, but smaller than the woodchuck, which they resemble.

Prairie dogs live in colonies varying in size from a few individuals to those which cover many square miles and contain hundreds of thousands of animals. They excavate an extensive system of deep burrows, in which they rear the young, usually four to six in number. They eat the stems and roots of native grasses, and their towns are often entirely bare except for a few hardy weeds such as dog fennel. They also feed on farm crops.

PRAXITELES, *praks it' e leez*. Ranking among the greatest of Greek sculptors, second possibly only to the master Phidias, was Praxiteles. He lived in Athens in the 300's B.C. A gifted worker in marble and bronze, he glorified the nude human figure, usually portraying the younger and less heroic of the gods and goddesses.

The only extant original work known to be his is *Hermes and the Infant Dionysus*, discovered in 1877 at Olympia. It is a work of grace and beauty, worthy of all the praise that has been showered upon the sculptor. Copies of some of his other works were made by Romans, and these still exist. One *Aphrodite at the Bath*, was said to have been the most beautiful statue in the world, and the people of Cnidus, for whom it was executed, valued it so highly they refused to part with it. *Niobe and Her Children* and a number of statues of Apollo are also attributed to him. See SCULPTURE.

PRECESSION, *pre sesh'un*, **OF THE EQUINOXES**, *e'kwi nok sez*. If you have ever observed closely the motion of a spinning top you have noticed that its axis (an imaginary line through its center) does not remain upright. If this line were extended upward a few inches, it would describe a circle in the air. The earth is doing exactly the same thing. If a line through the North Pole were extended millions of miles into space, it would describe a complete circle in the heavens every 26,000 years. This means that our Pole Star, Polaris, is not

always the star at the end of the handle of the Little Dipper, as it is now. About 4,000 years ago, a bright star in the constellation Draco was the Pole Star; some 12,000 years hence the bright star Vega in the constellation Lyra will be the Pole Star.

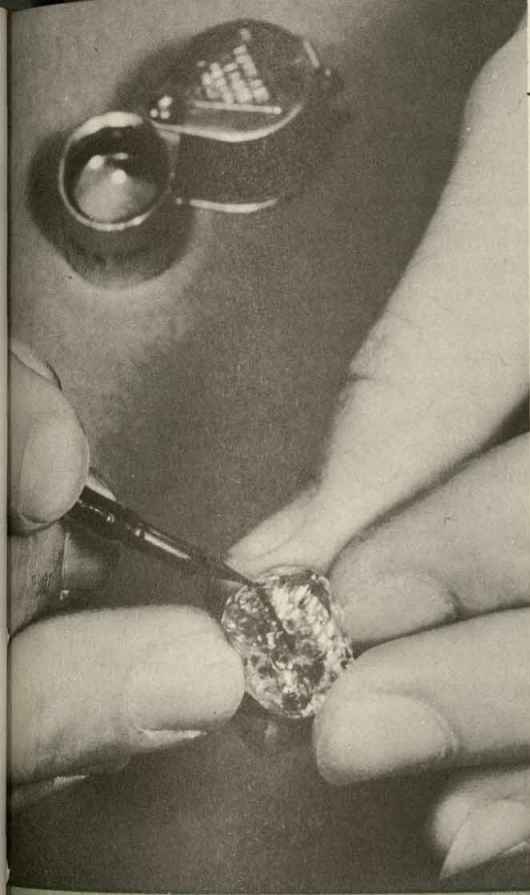
This strange motion of the earth is known as the precession of the equinoxes because it is evidenced on the earth annually by a very slight westward movement of the equinoxes, the points at which the ecliptic, or path of the sun, crosses the equator. The precession is the result of a joint gravitational pull by the sun and the moon on the equatorial ring of the earth. If the earth were a perfect sphere, such a motion would not be possible.

PRECIOUS STONES, or GEMS. From the dark, mysterious crevices of the earth and even from the body of the lowly oyster come the precious stones that have long been valued by man. The most important natural stones are the diamond, sapphire, ruby, and emerald, which are called precious stones. The opal, turquoise, topaz, amethyst, aquamarine, heliotrope, and garnet are known as semi-precious stones. The pearl, although not really a stone, is considered to be a gem.

Most precious stones are naturally rough and irregular and must be cut, polished, and engraved by experts before they are used. Often a large, valuable diamond will be studied for weeks before any attempt is made to cut it. The semi-precious stones are used in rings and brooches, those with sunken design being designated as intaglios, those with raised engraving, cameos.

The art of cutting gems dates back to the early Egyptians, Greeks, and Etruscans; modern gem engraving began in Italy and Germany in the fifteenth century.

The collection of gems dates back to early times, when the astrologers believed that certain gems had a profound significance on the lives of people. As a result of this belief, a certain gem has been set aside as the birthstone for each month of the year. Many of the ancients also ascribed certain virtues to each stone, and often wore



N. W. Ayer & Son, Inc.

A GEM IN THE MAKING

This rough diamond will be transformed into a brilliant gem. But first it must be divided so that it will have no flaws. Here, after careful study, an expert marks the stone with ink to show where it should be cut.

stones as charms to drive off disease and to foster good luck. In ancient Biblical times, stones were worn by the Jewish High Priests, giving off a magnificent radiance as though emanating from the presence of God. From time immemorial, jewel-encrusted crowns have been symbolical of kingly power.

Few precious stones have any practical value. The diamond, however, is often used in the manufacture of cutting tools, and rubies and a few of the other hard gems are used as "jewels" in fine watches. See BIRTHSTONES; GEMS, ARTIFICIAL.

PREMIER, *pre meer'*. In some countries the head of the Cabinet is the Premier, whose title means *first*. He may be called by a variety of names, such as Prime Minister, Chancellor, or Grand Vizier. Most con-

stitutional governments, with the exception of the United States, have adopted the British Cabinet form, in which one member of the Cabinet is selected by the king or President, and he, in turn, appoints the other members. There is no office in the United States which corresponds to this post.

Usually the Premier serves as the medium of communication between the ruler and Parliament and assumes responsibility for the introduction of new legislation. He is also usually the leader of the majority party or the central figure in a combination of parties. See CABINET; PRIVY COUNCIL; GREAT BRITAIN.

PREPOSITION, *prep o zish'un*. The part of speech that carries some meaning of position, time, direction, or other relation is a preposition. It is used to introduce a prepositional phrase, joining the principal word in the phrase and the word the phrase modifies. In the sentence "He saw a bird in the sky," *in the sky* is the prepositional phrase modifying the noun *bird*. The preposition is *in*. Other commonly used prepositions are *by, for, to, at, under, near, and over*.

PRESBYTE'RIANS. Adhering to the doctrines of John Calvin as laid down in the Westminster Confession of Faith, the Presbyterians, comprising some 3,600,000 members in the United States, form one of the large branches of the Protestant faith. In 1902 the General Assembly of the Church modified the Calvinistic doctrine so that now it teaches that God is the loving and supreme sovereign of all mankind and that no man is condemned except for his own sins, a viewpoint at considerable variance with the old doctrine of predestination.

The Presbyterian Church is governed by presbyters, or elders, who rule over the local church. The officers of the local church include the pastor, who, with the elders, looks after the spiritual welfare of the group; the deacons, who handle benevolent funds; and the trustees, who are concerned with the church's financial affairs. The pastor and the elders meet in session and have the power to admit and discipline

members. The session is controlled by the presbytery, composed of the minister and one or more elders from each of the churches of a given area. The presbyteries are in turn combined into *synods*, which form the General Assembly, the supreme governing body which meets annually and legislates on cases involving the doctrines and government of the Church.

Many consider John Calvin the founder of Presbyterianism, which became widespread in England in the 1500's, was approved by Parliament in 1647, but never became the country's official church. Under the leadership of John Knox, however, the Presbyterian Church became the official church of Scotland in 1560. The first Presbyterian Church in America was founded about 1640; the first presbytery at Philadelphia in 1706; and the first synod in 1716. Today the largest of American branches is the Presbyterian Church in the United States of America. A split over slavery led to the formation (1861) of the Presbyterian Church in the United States, confined to the South. In 1925 many Presbyterians joined Methodists and Congregationalists in forming the United Church of Canada. See CALVIN AND CALVINISM; KNOX, JOHN.

PRESIDENT OF THE UNITED STATES. The Chief Executive of the United States is the President, who is elected indirectly by the people for a term of four years. His duties are to enforce and administer all laws passed by Congress, to appoint certain officials, and to act as representative of the American people in their relations with other countries. He must be a natural-born citizen and be at least thirty-five years old. Under the Twentieth Amendment to the Constitution, adopted in 1933, the President takes office January 20, following his election. Under the Twenty-second (1951) no person may be elected President more than twice. See ELECTORAL COLLEGE.

The Succession Act. In 1947 provision was made for filling the office of President in case both the President and Vice-President should die or be disqualified. The

law provides that the following officers shall succeed the Vice-President, in the order given: the Speaker of the House of Representatives, president pro tempore of the Senate, Secretary of State, Secretary of the Treasury, Secretary of Defense, Attorney-General, Postmaster-General, Secretary of the Interior, Secretary of Agriculture, Secretary of Commerce, Secretary of Labor.

Salary and Duties. The salary of the President is \$100,000 a year, in addition to allowances for traveling and other expenses connected with his position as Chief Executive and resident of the White House.

When assuming office, the President takes an oath to "preserve, protect, and defend" the Constitution of the United States. He becomes Commander in Chief of the army and navy, and appoints, with the approval of the Senate, ambassadors and ministers, Justices of the Supreme Court, and numerous other officers. The President from time to time provides Congress with information and advice concerning the state of the nation, and under extraordinary circumstances can convene and adjourn Congress. See CONGRESS OF THE UNITED STATES.

PRESS, FREEDOM OF THE. See FREEDOM OF THE PRESS.

PREVAILING WESTERLIES. In the temperate regions of the earth there are strong winds from a general westerly direction that are called the prevailing westerlies. In the Northern Hemisphere these winds blow toward the southeast; south of the equator they blow toward the northeast. In certain places, where they are not blocked by land masses, they blow steadily, sometimes reaching high velocities. In the Southern Hemisphere they have such force that they are called the "roaring forties." In the Northern Hemisphere, however, they are often broken up by land masses.

PRI'AM. Famed in mythology as the last king of Troy, Priam had the unhappy task of defending his city against the Greeks. He was the son of Laomedon and had nineteen children by his second wife, Hecuba, among whom were Paris, Hector, Troilus, and Cassandra. Although the

PRESIDENTS OF THE UNITED STATES

	BORN—DIED	NATIVE STATE	OCCUPATION OR PROFESSION	POLITICAL PARTY	SERVED
1. George Washington.....	1732-1799	Va.	Planter	Fed.	1789-1797
2. John Adams.....	1735-1826	Mass.	Lawyer	Fed.	1797-1801
3. Thomas Jefferson.....	1743-1826	Va.	Planter	Rep.*	1801-1809
4. James Madison.....	1751-1836	Va.	Lawyer	Rep.*	1809-1817
5. James Monroe.....	1758-1831	Va.	Lawyer	Rep.*	1817-1825
6. John Quincy Adams.....	1767-1848	Mass.	Lawyer	Rep.*	1825-1829
7. Andrew Jackson.....	1767-1845	S. C.	Lawyer	Dem.	1829-1837
8. Martin Van Buren.....	1782-1862	N. Y.	Lawyer	Dem.	1837-1841
9. William H. Harrison.....	1773-1841	Va.	Soldier	Whig	1841 (1 mo.)
10. John Tyler.....	1790-1862	Va.	Lawyer	Whig	1841-1845
11. James K. Polk.....	1795-1849	N. C.	Lawyer	Dem.	1845-1849
12. Zachary Taylor.....	1784-1850	Va.	Soldier	Whig	1849-1850
13. Millard Fillmore.....	1800-1874	N. Y.	Lawyer	Whig	1850-1853
14. Franklin Pierce.....	1804-1869	N. H.	Lawyer	Dem.	1853-1857
15. James Buchanan.....	1791-1868	Pa.	Lawyer	Dem.	1857-1861
16. Abraham Lincoln.....	1809-1865	Ky.	Lawyer	Rep.	1861-1865
17. Andrew Johnson.....	1808-1875	N. C.	Tailor	Rep.	1865-1869
18. Ulysses S. Grant.....	1822-1885	Ohio	Soldier	Rep.	1869-1877
19. Rutherford B. Hayes.....	1822-1893	Ohio	Lawyer	Rep.	1877-1881
20. James A. Garfield.....	1831-1881	Ohio	Lawyer	Rep.	1881 (6½ mo.)
21. Chester A. Arthur.....	1830-1886	Vt.	Lawyer	Rep.	1881-1885
22. Grover Cleveland.....	1837-1908	N. J.	Lawyer	Dem.	1885-1889
23. Benjamin Harrison.....	1833-1901	Ohio	Lawyer	Rep.	1889-1893
24. Grover Cleveland.....				Dem.	1893-1897
25. William McKinley.....	1843-1901	Ohio	Lawyer	Rep.	1897-1901
26. Theodore Roosevelt.....	1858-1919	N. Y.	Publicist	Rep.	1901-1909
27. William H. Taft.....	1857-1930	Ohio	Lawyer	Rep.	1909-1913
28. Woodrow Wilson.....	1856-1924	Va.	Educator	Dem.	1913-1921
29. Warren G. Harding.....	1865-1923	Ohio	Editor	Rep.	1921-1923
30. Calvin Coolidge.....	1872-1933	Vt.	Lawyer	Rep.	1923-1929
31. Herbert Hoover.....	1874-	Iowa	Engineer	Rep.	1929-1933
32. Franklin D. Roosevelt.....	1882-1945	N. Y.	Lawyer	Dem.	1933-1945
33. Harry S. Truman.....	1884-	Mo.	Farmer	Dem.	1945-1953
34. Dwight D. Eisenhower.....	1890-	Texas	Soldier	Rep.	1953-1961
35. John F. Kennedy.....	1917-	Mass.	Legislator	Dem.	1961-

*The Republican, or Democratic-Republican, party of Jefferson, Madison, and Monroe is now known as the Democratic party. John Quincy Adams was a National-Republican.

Iliad of Homer makes no mention of his death, it is believed that he was slain by the son of Achilles when the Greeks conquered Troy. See TROY.

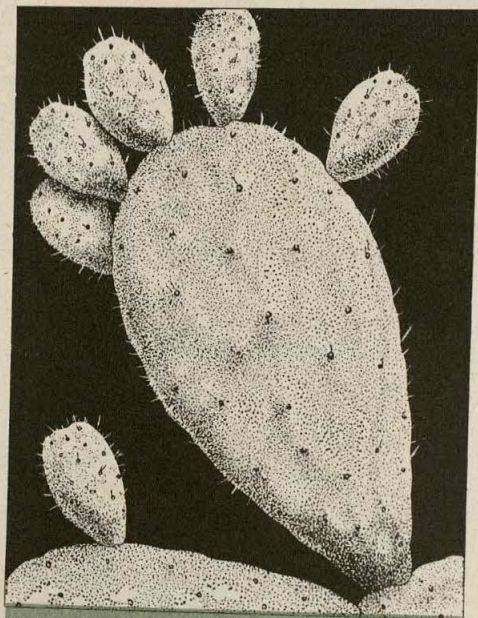
PRIBILOF, *pre' be lof*, **ISLANDS**. About 200 miles off the southwest coast of Alaska, in the midst of the icy Bering Sea, lie the Pribilof Islands, home of the world's finest seals. Discovered in 1786 and named for their discoverer, Gerassim Pribilof, the Pribilofs were acquired by the United States with the Alaska purchase in 1867. Saint George and Saint Paul are the largest of the group. Population, about 600.

No one can be sure just why the seals chose this spot for their home, but probably they were attracted by the isolation of the islands. Because repeated raids on the seals reduced their number to about 200,000,

treaties were signed restricting the annual kill. The number of seals has now increased to nearly two million. See SEAL.

PRICKLY PEAR, or **INDIAN FIG**. Originally cultivated by the aborigines of America, prickly pears are the fruit of a species of cactus belonging to the genus *Opuntia*. The opuntias are cultivated in the southwestern part of the United States, in Mexico, and in the West Indies.

The fine bristles which cover the fruit are frequently partially removed, sometimes before picking, by being rubbed with leaves or grass. The earlier varieties ripen in June and the later sorts ripen in November. In preparing the fruit for eating, a thin slice is cut from each end and a slit is made through the peeling joining the cut surfaces. The skin can then be separated from



SURVIVAL OF THE FITTEST

Growing in lands of scant food, prickly pears would be eaten by animals but for the spines.

the pulp. Care must be exercised to avoid contact with the prickles.

Certain varieties are free from prickles and these have been planted as a stock food. Varieties practically spineless were introduced from the Mediterranean a number of years ago. Luther Burbank has also developed spineless forms.

PRIEST. A religious officer, a priest interprets and explains the beliefs of his Church, performs religious ceremonies, and acts as a link between the worshipers and the Supreme Being in which they believe. The priest is a member of the hierarchy of such present-day Churches as the Roman Catholic, the Greek Orthodox, the Anglican, and the Episcopal. Priests of the Roman Catholic Church may not marry, but those of the other Churches may. In the Roman Catholic Church the priest is at the bottom of the hierarchy, but in the Episcopal Church priests form the second order of clergy, ranking below the bishops.

PRIMARY ELECTION. In a primary election, members of a political party are given an opportunity to select the candi-

dates they wish to represent the party in the general election. Primary elections are of two types, *open* and *closed*. In the open primary, names of all the nominees of both parties are printed on one ballot; the voter may vote for candidates of either party. In the closed primary, the voter must first declare his party preference and vote for candidates of one party; in this way the final choice of candidates for each party is obtained.

To have his name placed on a primary ballot, a candidate must have a petition signed by a required number of voters of the party which he is to represent.

The party-primary election originated in the United States and is now used in the selection of candidates, national, state, and local, in almost all states. See **ELECTION**.

PRIMATES, *pri ma' teez*. Comprising man, apes, monkeys, marmosets, and lemurs, the order Primates is the highest in the animal kingdom. It is a division of the class Mammalia.

Consult the following titles for additional information:

Ape	Lemur
Baboon	Mammals
Chimpanzee	Man
Gibbon	Monkey
Gorilla	Orang-utan

Zoölogy

PRIMOGENITURE, *pri mo jen' i ture*.

According to the right of primogeniture, the eldest son, the first-born of a family, inherits the estate of the father. The right was recognized by the ancient Hebrews and was highly developed during feudal days.

In most countries, including the United States, the right of primogeniture is no longer recognized. However, in England it has survived since the days of the Norman conquerors. When an estate is entailed, if the eldest son dies before he inherits, his eldest son or other children become the heirs. If there are no male children, all the female heirs share equally.

PRIM'ROSE. As the snow vanishes in the spring and the sun begins to warm the earth's crust, one of the first flowers to appear is the primrose, named from the Latin

primus, meaning *first*. Most of the 200 species of primroses are perennials and are widely scattered through North America, Europe, and Asia.

The *common*, or *European*, primrose, has a short, upright stalk on which are borne small, cup-shaped leaves and pale, yellow flowers, each on a short stem. This primrose is closely related to the cowslip.

The *Chinese* primrose is the species most often grown in America. From the midst of a furry cluster of leaves growing close to the ground, slender stems push up, bearing single or clustered blossoms of delicate pink, violet, or purple. The *Japanese* and several other primroses are also favorites in American gardens.

PRINCE. In general, all royal sovereigns and their heirs may be called princes, for the word refers to a person who holds the highest place in the kingdom. Usually, however, the name is given to a son of the sovereign. There are a number of European families of ancient ancestry, not connected with a ruling house, who use the title of prince. Some of the old German states used the title of prince (*Fürst*) for their monarch. In England, dukes and earls are occasionally called princes, and the royal heir has the title of Prince of Wales. Women of royal blood use the title princess. See WALES, PRINCE OF.

PRINCE EDWARD ISLAND. The smallest Canadian province, crescent-shaped Prince Edward Island lies but a few miles from the Maritime Provinces of Nova Scotia and New Brunswick in the southern part of the Gulf of Saint Lawrence. The area of Prince Edward Island is 2,184 square miles, slightly less than that of Delaware.

Geography and Resources. Prince Edward Island has no high mountains, nor is much of its surface occupied by monotonous flat areas except for a few marshes along the coast. Its surface is gentle and undulating. Although some areas are marked by reddish sandstone, most of its red-colored soil is well suited to dairying and light farming. The climate is cool in the sum-

mer, bracing and invigorating in the winter.

Most of the original forests have been cleared. The greatest of natural resources are the nearby fishing grounds, yielding large, valuable catches of oysters, lobsters, cod, herring, mackerel, and smelts.

Industries. The chief crops include potatoes, grains, turnips, hay, and fruits. Cattle, horses, sheep, hogs, and poultry also are raised. Fur farming originated here in 1887, and many silver-fox pelts have been exported.

Manufacturing is confined chiefly to the canning and preparing for export of farm and fisheries food products. Some lumber, flour, and feed are milled, and linens and flannels are woven for home use.

The beauty of the sea and of the countryside, excellent beaches, and picturesque Prince Edward Island National Park are some of the features that make tourism one of the province's leading industries.

People. Most of the island's over 102,000 inhabitants are native-born and of British descent. Education is available to all. Prince of Wales College, head of the province's school system, and Saint Dunstan's University (Catholic), both at Charlottetown, the capital, are the leading institutions of higher learning. The chief churches are the Roman Catholic, United, Presbyterian, Anglican, and Baptist.

History. The Cabots probably saw the island in 1407, but Cartier was the first white man to visit it, in 1534. Though first settled by the French, it was taken by the British in 1758. Five years later Britain's ownership became official, and the island was annexed to Nova Scotia. In 1769 it became a separate colony; in 1873, a Canadian province. Its government is administered by a lieutenant-governor and a thirty-member legislature.

PRINCE OF WALES. See WALES, PRINCE OF.

PRINCE'TON, BATTLE OF. George Washington showed his genius as a master of military strategy in the Battle of Princeton. Fought on January 3, 1777, it resulted in the saving of New Jersey for the colonial

forces, and also aroused new enthusiasm.

On January 2 Cornwallis occupied a position on the west bank of the Assunpink River in New Jersey, while Washington, with far fewer men, was directly opposite. At night Washington moved his entire army to the north, leaving his campfires

burning and a few soldiers at his former site to deceive the British. At Princeton he met an enemy force coming to aid the British, and won after a hard fight. Entrenching his men in Morristown, he forced Cornwallis to retreat to New York. See REVOLUTIONARY WAR IN AMERICA.



THE SPREAD OF LEARNING

This Antwerp print shop of 1600 did not produce books quickly by modern standards, but it helped disseminate knowledge. Left, the father of printing, Johannes Gutenberg.

PRINTING. The widespread distribution of knowledge, characteristic of the modern age, sets that age apart from the era of ancient civilizations. Printing has played a leading rôle in the spread of learning. It has made possible the publishing and cheap distribution of books, newspapers, magazines, and pamphlets by the thousands, putting before people the raw materials of knowledge and understanding. It was one of the greatest forces in awakening Europe from the intellectual lethargy of the Middle Ages, and was the means by which thousands of men were able to read the Bible and discuss it.

The Chinese, as in other important inventions, were the pioneers of printing. The oldest printed Chinese book known to exist bears the date of 868. Europeans began

printing from blocks of wood and metal sometime in the twelfth century. But printing from movable type, the foundation of modern printing, was not invented until the fifteenth century. Its invention is generally credited to Johannes Gutenberg of Mainz, Germany, about 1450; but claims have also been put forth for Lourens Koster, of Holland.

The early printers worked on crude wooden presses that turned out the pages of a book very laboriously, but the process was faster and better and cheaper than any method tried before. The first book to be made from movable type, between 1450 and 1456, was the Mazarin Bible, and Gutenberg was connected with its publication. William Caxton set up the first press in England in 1476, and the first printing es-



FROM COMPOSITOR'S "STICK" TO FINISHED PROOF

Top, left, a compositor sets display type by hand; right, locking up page forms. Below, left, inspecting press sheet; right, packing cylinder of a modern, high-speed printing press.

tablishment in America was set up in Mexico City about 1539. The first press in the United States was established in 1638 at Cambridge, Mass. The first reading material printed on it was the *Freeman's Oath*.

Modern printing consists of three processes. The first, *composition*, is the setting of the type either by hand or by machine (linotype or monotype). The type is arranged in galleys, proofs are taken of it, corrections are made, and it is ready for the

second step. This is *make-up*. The type is placed in a page form, or *chase*, in such a way that it will not fall out. The form may contain 2, 4, 8, 16, 32, or 64 pages. One side of a large sheet is printed and then the other side, and the sheet is folded to page size. For high-speed printing in quantity, the form is electrotyped or stereotyped, and the actual *printing*, the third step, is done from plates. Smaller presses, however, print directly from the type in the form. Large



OUTLINE OF LETTERPRESS

Top to bottom: left, setting type; right, assembling type and cuts; locking up in chase; making ready; and printing the sheet.



AND OF OFFSET LITHOGRAPHY

Top to bottom: setting type; assembling negatives of type and illustrations, and printing on plates; developing; printing. Letterpress and offset differ, yet can achieve similar results.

presses for newspapers and magazines use rolls of paper, while smaller presses use sheets.

At one time it was difficult to obtain satisfactory blendings of colors on high-speed presses, for the slightest variation of the four-color process — using red, blue, yellow, and black — will spoil a reproduction. Today, however, newspapers turn out very good color printing, and that used in books and magazines is usually excellent. Improvements in making paper, plates, and presses and in preparing “copy” for reproduction are continually helping to produce better color printing.

For additional information, consult the following articles:

Book	Linotype
Bookbinding	Lithography
Caxton, William	Monotype
Electrotyping	Newspaper
Engraving	Printing Press
Gutenberg, Johannes	Type

PRINTING PRESS. It is indeed a far cry from the quaint wooden press of Johannes Gutenberg that looked like a miniature guillotine to the roaring giant of steel that thunders in the newspaper pressroom. Gutenberg's press could print only a few pages in an hour, while the newspaper's behemoth eats up tons of paper in an unbroken roll and grinds out more than 50,000 copies of an edition consisting of many pages, in the same space of time.

Although there are many types of presses in existence, most of them have the same essential parts and functions. There must be a bed or cylinder for holding the type form or plate; a mechanism for inking the type or plate; a platen for impressing the type on the paper; a frame to hold all the parts, and a mechanism to operate them. Gutenberg's press was operated like the old wine presses. It had a flat bed for the form, another board above it for the platen, and a screw for pressing the platen on the form. Inking was done with a leather ball, stuffed with wool. The screw of the platen was operated by a lever.

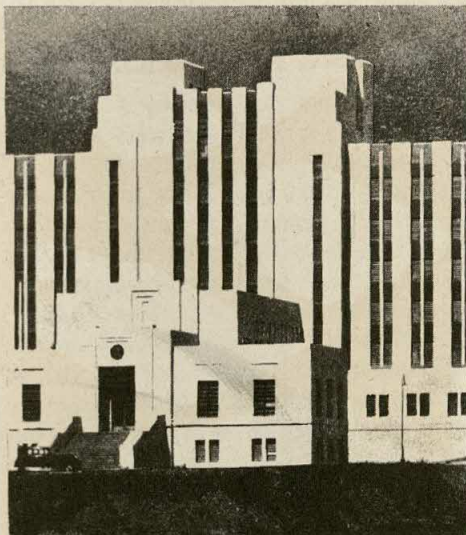
This press was used for several centuries without improvement; then iron was sub-

stituted for wood for the frame, a spring was added to the platen, and a lever was later substituted for the screw. Then followed inking devices and block and tackle mechanism for removing and placing the form. Finally, the cylinder press came into being in 1810, and four years later the *London Times* was printed on this press. It had a large cylinder which picked up a sheet of paper as it revolved, and pressed it on the type, which slid back and forth on a movable bed. As the type slid out from under the cylinder, it was inked by rollers. This type of press is still in use in many printing establishments.

In 1846 the rotary press was invented by Richard Hoe of New York. Using this as a basis, he developed the web-perfecting press, in which stereotyped page forms, each in the shape of a half-cylinder, are clamped to a cylinder. The cylinders are placed so that the paper, which comes from a roll at one end of the press, is printed on both sides at once as the cylinders revolve. This type of press has been improved and speeded up so that it can print many pages at once at high speed. The double-octuple press, for instance, will print 54,000 copies per hour of a thirty-two page paper. It uses eight rolls of paper, each twice as wide as the newspaper page and five miles in length. The web-perfecting press also is used extensively in the printing of magazines and books of large distribution. See **PRINTING**.

PRISM, *priz'm*. A geometric solid whose top and bottom sides are parallel and equal to each other and whose other sides have parallel edges is a prism. The top and bottom faces are the *bases* and the other sides are the *lateral faces*. For example, an unsharpened six-sided pencil is one form of prism, the top and bottom forming the bases, and the sides the lateral faces. When the edges of the lateral faces are perpendicular to the bases, the prism is a *right prism*; in other positions it is an *oblique prism*.

The area of the surface of a prism is equal to the perimeter of the base multiplied by the perpendicular distance between the two



Courtesy Portland Cement Association

LABORATORY OF REFORM

The modern prison seeks to help society by rehabilitating those who have made mistakes instead of taking revenge upon them.

bases, plus twice the area of one of the bases. The volume is equal to the area of one base multiplied by the perpendicular distance between the two bases. In physics, a triangular prism of a transparent material is employed to break up white light into its component colors. See **LIGHT**.

PRISON, *priz'n*. Persons who have been found guilty of serious offenses against society are detained in a prison, or penitentiary. In an earlier day there was practically no distinction between a jail and a prison. The modern jail is a place of detention for minor offenders sentenced for brief periods and for those under arrest who are awaiting trial; the prison is reserved for those of mature years who are under sentence for serious crimes.

Prison Reform. A prison has for centuries been considered a place of punishment—a spot where society in hardness of heart takes revenge against those who outrage it. Today it has another purpose. While the ends of justice are not neglected, there is a reformatory spirit which is attempting to change the attitude of the criminal, so that in time he may leave the

institution with the hope of restoration to good citizenship.

A Typical Institution. State prisons are established and supported by public taxation; in some instances convict-labor contracts return a profit which lessens the public burden. Certain physical features are common to nearly all prisons. There is a high wall of masonry entirely surrounding the institution, surmounted by sentry towers. Inside are the workshops and cell houses and all other buildings necessary to administration. A library, a chapel, and an athletic field are usually included. Many prisons maintain farms on which are employed convicts of the type to be granted a measure of freedom safely; some states employ convicts on roadmaking, housing them temporarily in armed camps. Before World War II, there was much idleness in some prisons because there were no shops; but during the war most inmates were engaged in making military supplies.

In charge of each prison is a warden, under whom are deputies. The warden is usually appointed by the state executive, and he is personally responsible for the conduct of his institution.

Reformatories. Young criminals are imprisoned in reformatories, to which older and hardened transgressors are not sent. The regulations here are somewhat less severe, although rigorous, and there is greater possibility of reformation of the inmates, who do not, as a rule, come into contact with lower types of criminality.

Federal Penitentiaries. To state prisons and reformatories are sent violators of state laws. Those who transgress Federal statutes are imprisoned in penitentiaries established and maintained by the national government. Among the crimes of which the Federal courts take cognizance are mail robbery, kidnaping, counterfeiting, smuggling, and violations of internal-revenue laws.

PRIVATEER'. From the late seventeenth century to the early nineteenth century, privateering was sanctioned by nations as a means of harassing an enemy on the

high seas. Privateers were privately owned vessels whose owners were commissioned by governments to raid and destroy enemy ships. Authorizations from governments to privateers were called *letters of marque*. America's navy in the Revolutionary War was composed almost entirely of privateers.

Because the owner of the ship received all the booty, the practice was much abused and gradually fell into disfavor. In the Declaration of Paris (1856) the nations of Europe agreed to outlaw privateering.

PRIVET. The Old World has given us this genus of ornamental, woody plants belonging to the olive family. Privets, with their handsome foliage and small but attractive white flowers, are among the most valuable shrubs known to landscape gardeners. They can be grown on almost any soil, in almost any climate, and for almost any purpose. The *common* privet is well suited to city shrubberies because it is not affected much by smoke and dust. The *California* privet, which is nearly evergreen, is widely used as a hedge plant. It is, however, not hardy north of Long Island, nor far inland. This species thrives near salt water.

PRIVY COUNCIL. Once a powerful body in the government of Great Britain, the Privy Council today exercises only formal duties. It may be said to be the medium for expressing the king's orders, issued only on the advice of his ministers. Its members, appointed by the king, are men who hold high positions in the kingdom. Their membership in the Privy Council ends six months after the death of the ruler, but it is customary for the succeeding monarch to reappoint them.

The Privy Council descended from the Great Council of the King and held its greatest power in legislative, advisory, and judicial functions of the government under Henry VI. Parliament has taken over the legislative functions, while the Cabinet, theoretically a committee of the Privy Council, possesses the advisory duties. The judicial committee of the Privy Council, however, still exercises authority.

PRIZE FIGHTING. Fame, wealth, and glory attend the champions of the prize ring, who follow a sport that harks back to the days of Greece and Rome. In prize fighting, the contestants receive a purse which may vary from a small sum to thousands of dollars. Prize fighters are divided into various weight classes, including heavyweight, light heavyweight, middleweight, welterweight, lightweight, featherweight, bantamweight, and flyweight. See BOXING.

PRODUCTION. Utility is the watchword of production, which involves one or more of these operations: (1) altering the form of goods, such as rearranging or combining them; (2) transporting goods from place to place; and (3) storing them until they are needed. Goods are not completely produced until they have the form desired and are at the proper place at the proper time.

In the making and selling of bread, we have an example of production at work. From the soil, seed, sunlight, and moisture, the farmer produces wheat. Wheat is consumed in flour mills (*productive consumption*) and flour is produced. Flour is sold by means of various agencies, such as advertising, which are productive in that they bring the buyer and seller together. The baker consumes flour in making bread. The loaves are then sold to the consumer.

The three important factors of production in the present social system are *labor*, *capital*, and *land*. Labor includes all human activities, intellectual and physical, involved in production. All instruments which enable man to produce goods are classified as capital—tools, machinery, buildings, money, and means of transportation. Forests, minerals, soil, water, and other resources fall into the category of land.

For additional information, consult the following articles:

Consumption
Distribution

Division of Labor
Marketing

PROFIT. The basis of the economic system existing in most countries today is profit. The term means the surplus on hand

after the expenses of an enterprise have been met. In other words, the amount of money a businessman has left in excess of the expense necessary to produce and market his goods is his profit. A businessman, to stay in business, must have a profit. He must sell his goods for a higher price than he pays for raw materials, for wages, for equipment, for interest charges, and for all other outlays of money combined.

Not only the producer of goods but the owner of land, or real estate, wants a profit on his investment. If he sells his land, he must sell it for more than he paid for it, plus taxes and any other expenses, if he is to make a profit. If he has houses or stores or office buildings on his land, he must rent them at a price that will give him a profit after he has paid his taxes and has paid for the general upkeep of the property.

There are, however, people who are opposed to the present profit system. For example, in Russia today production is not in private hands but is government-controlled. In some countries co-operative associations have been organized in which the members control the purchase and distribution of goods, thereby eliminating the profits of middlemen (see CO-OPERATION). Socialists believe that the means of production should be in the hands of the workers.

It can be seen, therefore, that all do not agree on the subject of the profit system. Under our present economic setup, however, it is clear, as stated above, that a profit is necessary if a business enterprise is to keep going.

PROFIT SHARING. When employees are given a portion of the profits, in addition to regular wages, a business enterprise has adopted the profit-sharing plan. Such sharing of profits takes one of several forms: It may be a cash sum yearly, in proportion to length of service or importance of position held; in lieu of cash, shares of stock in the company may be allotted; the money intended for employees' benefits may be placed in a pension fund, to be drawn upon as the age for retirement arrives, or upon the death of an employee.

Various other devices may be adopted to fit into fundamental practices in the management of a company. The idea of profit sharing has spread rapidly since its inception (in France), about the middle of the nineteenth century.

PROGRESSIVE PARTY. See **POLITICAL PARTIES IN THE UNITED STATES.**

PROHIBITION, *pro hih bish'un*. The Eighteenth Amendment to the Constitution of the United States, prohibiting the manufacture or sale of alcoholic beverages, resulted from years of crusading to end intemperance. It remained in force nearly fourteen years.

Misuse of whisky, wines, and beer began to be an important political issue in the nineteenth century, and in 1872 the Prohibition party entered its first candidate in a Presidential election. Such organizations as the Woman's Christian Temperance Union and the Anti-Saloon League exerted strong influence.

In 1920 the Eighteenth Amendment went into effect; but with prohibition came considerable popular resentment. Bootlegging flourished, and there was open violation of the law. In 1933 the Twenty-first Amendment repealed prohibition.

PROHIBITION PARTY. See **POLITICAL PARTIES IN THE UNITED STATES.**

PROMETHEUS, *pro me'thuse*. Because he dared to steal fire from heaven and bring it to earth, Prometheus was punished for centuries by Jupiter, according to classic mythology. An eagle would come each day to the rock where Prometheus was chained, and devour his liver, and the organ would grow back during the night. Prometheus, whose name means *forethought*, was said to have been the brother of Atlas and Epimetheus, and is known in literature as a Titan. Hercules freed Prometheus from his torture.

PRONG'HORN. Probably the swiftest wild animal which runs on the American continent is the pronghorn, or pronghorn antelope. The animal is less than three feet tall at the shoulder, and only about four and a half feet long. A characteristic fea-

ture is a prominent white rump. Both sexes have horns which are shed annually. In this respect pronghorns are unlike the true antelope of the Old World (see **ANTELOPE**).

Pronghorns are found from Canada to Mexico, and from the Missouri River to the Rocky Mountains.

PRO'NOUN. In grammar, any word used instead of a noun is called a pronoun. The noun for which it stands is called the pronoun's *antecedent*. In the sentence, "This is the boy who was injured," *who* is the pronoun, *boy* the antecedent. The most commonly used pronouns are:

Personal—You, me, she, them, it.

Possessive—Ours, hers, his, theirs.

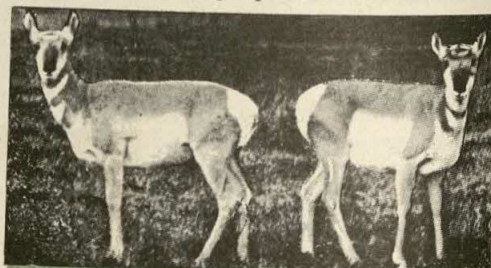
Demonstrative—This, that, these, those.

Interrogative—Who, whose, which, what.

Relative—Who, that, which, what.

Indefinite—Some, few, many, much.

PROPAGAN'DA. Taken from a Latin word meaning *to cultivate* or *to spread*, the word propaganda now means information deliberately spread and cultivated among groups of people, in order that these



NORTH AMERICAN SPRINTERS
Once fast-disappearing, now legally protected,
pronghorns are increasing in number.

groups may form certain opinions or behave in a certain way.

Propaganda may be truthful and beneficial, or untruthful and harmful. Legitimate, truthful propaganda is constantly in use by public and private institutions, and it constitutes a valuable source of information. Familiar examples are campaigns for civic improvements, for help for victims of disasters, or for aid to needy persons. Propaganda used thus is simply a collection of related facts, presented to the public in an interesting manner.

Propaganda is often used by minority groups to influence legislation or to protect special interests, and this type of propaganda is often misleading or false.

A dangerous form of propaganda is that spread by a nation at war. It sometimes consists of actual facts; almost always, however, damaging facts are suppressed and encouraging reports are exaggerated. A clever propaganda bureau may use facts or falsehoods, or a combination of both, for several purposes: to damage enemy morale, to influence national behavior, or even to change world opinion.

An example of this technique is the

"border incident." A country seeking an excuse to invade a neighboring nation may manufacture border warfare by the device of secretly sending agents across the border. The agents then attack their own countrymen who guard the border, and the propaganda bureau releases to the world the news of "attack by enemy troops."

During the Second World War, the belligerent nations used propaganda extensively, each side endeavoring to sway world opinion and put pressure on neutrals. In fact, a number of conquests were fully accomplished by the use of propaganda.

PROTEC'TION. See **TARIFF.**



THERE'S MORE HERE THAN MEETS THE EYE
(1) The striped tiger blends into the forest floor. (2) Camouflaged caterpillar. (3) An East Indian insect apes a leaf. (4) The Arctic fox's coat against snow.

PROTEC'TIVE COLORATION AND MIMICRY. In modern warfare, battle-ships, tanks, artillery batteries, and even roads are so cleverly concealed (camou-

flaged) by paint and canvas strips that the enemy is often unable to locate them from scouting planes.

The idea of protective coloration is not

new, however, for Mother Nature has for centuries protected some of her animals by giving them a coat strikingly similar to the surroundings in which they live. The tree frog becomes almost invisible against the bark of a tree. Frogs and snakes living in grass are often colored green for safety against their enemies. The snow-white polar bear living among snowy wastes, the spotted leopard, the striped tiger, and even the hare and weasel, which have dark coats in the summer and light ones in winter, are all typical examples of protective coloration. Another animal thus protected is the chameleon, which changes color because of its physical surroundings or from fright or other emotion.

Mimicry. Protective coloration of insects is a form of mimicry, but mimicry also includes resemblance in form as well as in color. The walking stick, a well-known insect, bears a striking resemblance to a common twig, as do some caterpillars which stand out rigidly from the branch when alarmed, making the resemblance even more striking. The king snake resembles the coral snake; there is a fly which looks like a bee; a spider, like an ant; and many other examples of mimicry.

PROTECTORATE. When a strong nation assumes the position of defender, adviser, and diplomatic agent for a weaker country, a protectorate is established. Under international law it is generally accepted that the dependent country retains the right to conduct its own internal affairs. The understanding between the two countries is usually stated in a treaty. The League of Nations mandates were a form of protectorate. Their place was taken by the United Nations trusteeships; these were provided for in 1945 by the Charter of the United Nations.

The protecting country receives certain advantages in return for military guarantees and diplomatic responsibility. Usually financial and trade rights are involved, as well as options for development of the protected country's resources. Protectorates are not always as benevolent as they seem to be,

some dependent countries actually becoming little more than colonies of the stronger power.

PROTEINS, *pro'te inz.* Of the few substances absolutely essential to maintaining human life, none is more important than protein. This substance always contains carbon, oxygen, nitrogen, and hydrogen; usually there is some sulphur, and several other elements, such as iron and phosphorus, are often included. The primary function of proteins is to build up the tissues of the body. They also supply energy and assist in oxidizing (burning up) carbohydrates and fats to produce heat in the body. The most important food sources of proteins are eggs, lean meat, skimmed milk, cheese, nuts, peas, and beans. Green vegetables, fruits, sugars, and starches furnish little or none.

Scientists have found that the average adult male needs from seventy to eighty-five grams of protein daily. Children need much more in proportion to their weight, for their bodies must be nourished both for energy and for tissue building.

PROTESTANT EPISCOPAL CHURCH. See ENGLAND, CHURCH OF; EPISCOPAL CHURCH.

PROTESTANTS, *pro'tes tants.* Until the Reformation the Roman Catholic Church was the only important Christian organization in Europe. After the revolt of Martin Luther, however, different sects of Christians sprang up, and the various Churches today which profess Christianity, but reject the tenets of the Catholic faith, are called Protestants.

The name was not given the followers of Luther until 1529, when high officials of the Roman Catholic Church decreed that all non-Catholic Christians return to the Church. This was *protested* by many princes and free cities, and so they were called *Protestants*. This name then was given to the followers of the Lutheran Church, and the others that came later. Although there are numerous Protestant Churches, most of them differ only slightly in creed. There have been several occasions

when two Churches reconciled their differences and combined: for example, three Lutheran Churches in the United States formed the United Lutheran Church, and in Canada the Methodists, Congregationalists, and Presbyterians have combined into the United Church of Canada.

For additional information, consult the following articles:

Congregationalists	Methodists
Luther, Martin	Presbyterians
Lutherans	Reformation, The
Religion	

PROTOPLASM, *pro'toh plaz'm*. The familiar question—"Which came first, the chicken or the egg?"—will never, perhaps, have a satisfactory answer. A biologist will say that neither came first, for before either there was protoplasm. Its name means, in Greek, *the first thing formed*.

Nearly three centuries ago, English and Italian scientists, studying cork and charred wood through their primitive microscopes, discovered that plants are made up of myriads of tiny divisions, so suggestive of a honeycomb that they named them cells. Later other scientists found that these cell walls are filled, in growing plants, with what seems a living substance, and that it is apparently the same substance as that which composes animal cells. In slime mold and some others of the lower types of plants, this substance, protoplasm, occurs unwallled, and is found to be not unlike the white of an egg.

When active protoplasm is present in plant bodies, they are able to manufacture and assimilate food, to grow, and to reproduce themselves. One of the essentials to activity is the presence of water. Without water, protoplasm becomes dormant, or if too long without it, dead. See CELL.

PROTOZOA, *pro toh zo'ah*. Comprising the lowest branch in the animal kingdom, protozoans are one-celled animals which have no stomachs, lungs, brains, or blood vessels. Nor do they have eyes, feet, noses, or mouths in the true sense. Nevertheless, protozoans eat food. They digest it and rid their bodies of undesired material wastes. They move, though they have no

true legs. They are able to know the difference between light and darkness, and they seem to be able to taste their food, for there are some things which they will eat and some which they will not. The behavior of protozoans is usually illustrated by that of one example, the amoeba, the simplest of animals. See AMOEBÆ.

PROVERBS. The greatest of the old Hebrew "Wisdom Literature" is collected in the Old Testament book called *Proverbs*, a work once credited to King Solomon, but now believed by critics to be the work of several authors and written over a long period of time. It is made up of a series of short poems, epigrams, and words of advice. The book is comprised of several distinct parts, and it is thought that the writings were gathered together some time after the Babylonian Captivity.

PROVIDENCE, R. I. Just sixteen years after the Pilgrims landed at Plymouth Rock, Roger Williams, together with a handful of followers, fled from Salem, Mass., to escape the wrath of certain religious fanatics. Stumbling through the woods in the dead of winter, he finally came to the region now included in Rhode Island. In 1636, at the head of Narragansett Bay, he founded a settlement called Providence, in commemoration of his God-given escape through the perilous woods.

Providence is the capital of Rhode Island and the second-largest city in New England, with about 210,000 people. Like ancient Rome, it is built on seven small hills, overlooking the valleys of the Seekonk and Providence rivers. Many of the dwellings of this irregularly built city date from colonial times, and the streets of the older part of the city are narrow and crooked, like those of Boston. Numerous parks, the most important being Roger Williams Park, are flanked by fine boulevards, gardens, and lakes.

Art and historic museums, Rhode Island Historical Society, and several libraries make the city a great cultural center. Brown University and other institutions of higher learning mark it as an educational center.



FOUNDER OF PROVIDENCE

This monument to Roger Williams stands in a Providence park willed to the city by a lineal descendant of its founder.

The city is noted for its jewelry and silverware. Its many other manufactures include textiles, chemicals, optical and rubber goods, machinery, and tools.

Only thirty-five miles from the open sea, at the head of navigation on Narragansett Bay, Providence has a harbor thirty feet deep and ample docking facilities. Foreign trade has been constantly encouraged and is growing rapidly.

After its founding, Providence grew slowly, for after 100 years it numbered but 4,000 inhabitants. The city claims the honor of being the birthplace of religious tolerance, and the first Baptist Church in America was organized in Providence. During King Philip's War, in 1676, about one third of the town was destroyed by the Indians. In 1815, its growth was further hampered by a devastating flood. It was incorporated as a city in 1832, and its recent growth has been rapid.

PROV'NCE. Large administrative divisions in many countries are called provinces. In Canada, for example, the various provinces are geographical divisions corresponding to states in the United States.

Provincial government is vested in a legislature, a judicial branch, the premier and cabinet of the majority party, and a lieutenant-governor appointed by the Governor-General of Canada.

The province has control of education, roads, drainage, natural resources, licenses, and other provincial affairs. Unlike the system prevailing in the United States, where the states have all the powers not delegated to the Federal government, all powers are vested in the national government except those granted to the provinces.

See CANADA, DOMINION OF.

PRUNE. One of the most healthful of fruits, the prune is produced by drying or preserving certain varieties of plums. The finest prunes are grown in the Loire Valley in France, although Spain, Portugal, Germany, Austria, and the Balkans are also



FRUIT FOR BREAKFAST TABLES

Tasty prunes are dried plums.

important sources. California, Washington, and Oregon produce most of the prunes consumed in the United States. Prunes grow best in fertile, well-drained soils and in a warm, sunny climate. They are harvested when fully ripe, when their sugar content is at its maximum. The juice of prunes is an important source of vitamins and is popular as a health drink for both infants and adults.

PRUSSIA, prush' a. Ruled by the Hohenzollerns who were also the emperors of Germany, the kingdom of Prussia, a rich, powerful, and populous state, was the nucleus of the German Empire which existed



HE ESTABLISHED THE PRESTIGE OF PRUSSIA

Frederick II, called Frederick the Great, was a brilliant general, added much to Prussian territory. Here he leads his troops.

from 1871 to 1918. When Germany became a republic, in 1919, Prussia lost much of her political influence but nevertheless remained Germany's most important state. But she lost her predominant position in 1933, when the Nazis consolidated all Germany under one governmental system.

Prussia lost considerable territory under the Versailles Treaty after World War I. Posen and West Prussia were ceded to Poland, and Danzig was internationalized. East Prussia was cut off from the rest of the country by the Polish Corridor, and part of Schleswig was returned to Denmark. In 1939, Germany recovered Danzig, the Posen district, and the Polish Corridor, but lost them again in 1945 as a result of her defeat in World War II. The Potsdam agreement between the United States, Great Britain, and Russia awarded parts of East and West Prussia to Russia; the rest of East Prussia, Danzig, and the Polish Corridor were promised to Poland.

The Growth of Prussia. The growth of Prussia from a tiny electorate of Brandenburg to a powerful German kingdom which became the center of the empire is largely the story of the Hohenzollern family. Originally the Prussians were a Slavonic people who inhabited the coastal lands between the Niemen and Vistula rivers. A Hohenzollern came to power in the Polish fief of East Prussia in 1511 and eventually succeeded in declaring the area a duchy, naming himself hereditary ruler. In 1618 the duchy was added to the electorate of Brandenburg, then controlled by another member of the family, John Sigismund.

John Sigismund was followed by his son, George William, who proved unequal to the task and lost much of his power during the Thirty Years' War. He was succeeded by his son Frederick William, the "Great Elector," who is generally regarded as the founder of the Prussian monarchy. His

son, Frederick I, was crowned the first king of Prussia in 1701. Frederick William I succeeded him in 1713.

Frederick II, called "the Great," succeeded to the throne in 1740. He increased Prussian prestige with the successful Seven Years' War against Maria Theresa of Austria, and through the addition of West Prussia from the first partition of Poland in 1772. Frederick William II (1786-1797) lost to France much of Prussia's land west of the Rhine, but this loss was counterbalanced by the addition of new territory in the east by two more partitions of Poland.

Frederick William III, who came to power during Napoleon's ascendancy, attempted to keep out of the European struggle. His attitude, however, alienated the other German states, which formed a confederacy, leaving Prussia at the mercy of Napoleon. Prussian defeats at Jena and Auerstadt brought the loss of territory between the Rhine and Elbe rivers.

With far-reaching reforms in the state under able ministers, Prussia regained her old strength and took part in the final defeat of Napoleon. At the Congress of Vienna, Prussia received valuable additions of territory.

At the same time the German Confederation was formed, with the provision that each state be given a constitution and a diet. This provision was largely disregarded, however, until the revolution of 1848. Under William I, who succeeded to the Prussian throne in 1861, the German Empire became a reality, and William was crowned emperor of Germany in 1871.

The Hohenzollerns continued to rule Prussia until the end of World War I, when it became one of the states of the German Republic. Then in 1934 it lost its rights as a sovereign state and became only an administrative division of the German Reich. Under the Potsdam Agreement of 1945, large chunks of Prussia's eastern territory passed into the possession of Poland and Soviet Russia.

Consult the following titles for further information:

Bismarck-Schönhausen	Germany
Danzig, Free City of	Hohenzollern
Franco-German War	Schleswig-Holstein
Frederick II	Seven Weeks' War
Frederick William	Seven Years' War
Frederick William I	Succession Wars
William II	

PRUSSIC, *pru's'ik*, **ACID**, or **HYDRO-CYANIC**, *hy dro sy an' ik*, **ACID**. Originally made from Prussian blue, prussic acid is one of the most powerful and violent poisons known to man. It was discovered by Scheele in 1782, but not until 1811 was it prepared in the pure form. Prussic acid is a colorless liquid which may be made by combining sodium cyanide and sulphuric acid. A single drop on the skin may cause death, and there is no antidote for this poison.

The seeds of peaches, plums, cherries, apricots, and the leaves of cherry, laurel, and beech are all natural sources of prussic acid. It sometimes forms in the stalks of stunted corn, bringing death to animals.

PSALMS, *sahmz*, **BOOK OF**. There is no more beautiful poetry in all the world than that to be found in the *Book of Psalms* in the Old Testament. There are in the collection 150 Hebrew poems or hymns, most of which are in praise of Jehovah. Some versions of the Bible contain an additional psalm. Most poems in the *Psalms* are credited to King David, but the authors are not definitely known. The collection probably represents the works of Jewish poets of several different periods, but nevertheless there is in each poem deep spirituality, as well as that typical parallelism of expression which characterizes much Hebrew poetry.

PSYCHE, *si'ke*. The story of the mortal Psyche and the immortal Cupid is one of the most charming tales in ancient mythology. It concerns a maiden of great beauty, Psyche, whose loveliness aroused the jealousy of the goddess of love, Venus. Venus sent her son, Cupid, to kill Psyche or see that she fell in love with some ugly wretch. But when Cupid saw Psyche, he lost his heart to her and took her as his wife. Always, however, he managed to conceal his face, seeing her mostly at night, and

she promised never to attempt to see him.

One night, however, Psyche became so disturbed over the curiosity of her sisters that she held a lamp over the god. Cupid then left her because she had broken her promise, and she spent many years in a fruitless search for him. Venus forced her to perform many difficult missions, among them to bring from Hades a box containing the secret of beauty. Upon opening the box, Psyche fell in a swoon on the road. There Cupid saw her, took pity upon her, and carried her off to Olympus, where he persuaded the gods to make her immortal. Today Psyche is the symbol for the human heart and soul, and the difficulties it must surmount before it attains perfection. See CUPID.

PSYCHOLOGY, *sy kol'o ji*. Long before men knew about even the simplest scientific methods and instruments, they began to wonder just why human beings act as they do, why they are happy or sad, and what happens when they think or see or imagine things. Some of the questions early students asked themselves were: "What is memory? Why do people have feelings and emotions? What makes the individual active, and what occurs within the human mind when activity takes place?" For centuries men thought about these things before much was discovered about human nature.

Psychology answers all these questions and more, for it is the scientific study of the activities of the individual. Until the middle of the nineteenth century, little practical use was made of this science; in fact, up to that time it was not a science at all, for it was only the philosopher who seriously speculated about the problems that had been puzzling mankind.

Although psychology as a definite, separate science is comparatively new, the term itself is old, having been used in ancient times. Aristotle, the Greek philosopher, defined psychology as the study of the soul; later thinkers called it the study of the spirit or even the study of the physiological aspects of man. It remained, however, for

the first scientists in 1850 to establish the connection and the interdependence of the mind and body of man. Wilhelm Wundt, in 1879, set up a psychological laboratory at Leipzig, Germany. The experiments that he performed laid the foundations for a new science, and he is considered the father of modern psychology.

Students working under Wundt went to other parts of the world and established psychological laboratories. The first great American psychologist was, possibly, William James, who made some of the most important contributions to the science and demonstrated its practicability in nearly all phases of human life.

What Psychology Is. Psychology stands between physiology on one side, and social science on the other. Physiology deals with the brain, the eye, the muscles, and the glands; psychology studies the individual as a whole. Social science deals with groups of people; psychology deals with the individual. Psychology studies the child as well as the adult, and the abnormal as well as the normal, for immature and disordered activities are often very revealing. It studies the mind and the body, recognizing that the centers of action are localized in the brain, although each is dependent upon the other. The psychologist also studies the actions and habits of animals.

The modern psychologist uses several methods to arrive at his conclusions. The experimental method is the most exact and requires a fully equipped laboratory. Here, with various instruments and apparatus, the psychologist measures muscular reaction, observation response, and many other things. Another method is the use of the case history, which tells of the individual's heredity and environment. A third method is the use of various tests which reveal the individual's native ability, intelligence, aptitudes, and achievements.

Among the various human characteristics with which the psychologist deals are intelligence, memory, learning, heredity and environment, activities, feelings and emotions, sensation, observation, personal-

ity, habits, instincts, thought, and imagination. There are several classifications of the science, such as *physiological* psychology, *child* psychology (or the mental development of the child), *vocational* psychology, *industrial* psychology, *educational* psychology, and *abnormal* psychology, which deals with the insane and mentally unbalanced. Among the students of psychology there have grown up several schools, or groups, that use different methods and who disagree over a number of fundamental principles. The outstanding schools are the *animistic*, the *structural*, the *Gestalt*, and the *behavioristic*.

The value of psychology has been proved in nearly all fields of human activity. The teacher finds it useful in dealing with his pupils, the employer can discover the aptitudes of his employes and give them the work for which they are best fitted. Parents find it helpful in guiding the mental growth of their children. The individual is better able to choose his career. In fact, anyone who deals with people will find psychology helpful.



PTARMIGAN, COLD-CLIMATE BIRD

PTARMIGAN, *tahr'mi gan*. Most remarkable is the way this grouselike bird of northern regions and high mountains changes color with the seasons. In summer it is reddish or grayish brown, in spring and fall it is mottled brown and white, and in winter almost pure white. Thus the color fits in with the landscape at each time of year and helps to protect the bird, which must spend most of its life on the ground in treeless regions. Another feature of the ptarmigan is that its legs and toes are covered with feathers which are much longer

and heavier in winter. There are three species of ptarmigan in North America, the two most common being the *willow* ptarmigan and the *rock* ptarmigan of the Arctic region. In the Rocky Mountains as far south as New Mexico the *white-tailed* ptarmigan lives.

PTERIDOPHYTES, *ter'i doh fites*. Plants which have roots, stems, and leaves, but bear no seeds, are pteridophytes. They form one of the four great divisions of the plant kingdom and constitute the highest of the groups of flowerless plants. The group is composed of the ferns, horsetails, club mosses, and quillworts. Nearly all our coal has been formed by the compressed remains of pteridophytes. See BOTANY.

PTOLEMY, *tol'e mi*. Glories of the Egypt of the Pharaohs were restored in part under the Ptolemy line of rulers, who came to power with the death of Alexander the Great.

Ptolemy I was a Macedonian general under Alexander. When Alexander died, in 323 B. C., and his empire was split up, Ptolemy took Egypt and reigned until 285 B. C., when he placed his son on the throne. Called "Soter," or "Savior," Ptolemy brought Alexandria a new era of culture, built the famous lighthouse on the island of Pharos, and founded the great Alexandrian library.

His son, **Ptolemy II**, continued the peaceful reign of the first Ptolemy until 246 B. C., and directed the internal affairs of the country well and judiciously.

Ptolemy III was also a wise ruler and a patron of culture. In addition he had a brilliant military career that brought prosperity to Egypt. His reign lasted until 221 B. C.

Rome first was able to interfere in the affairs of Egypt under **Ptolemy V**, who was only five years old when he ascended the throne in 204 B. C. Immediately, Philip V of Macedon and Antiochus III of Syria plotted to take his land, and the king's guardians were forced to seek the protection of Rome. The Romans followed up their advantage until the land of the Ptolemies had declined to the status of a province.

Ptolemy XII was a brother of Cleopatra

and reigned jointly with her from 51 to 47 B. c. When Cleopatra quarreled with her brother, Caesar came to her aid, defeating him. Ptolemy was accidentally drowned. Another brother, **Ptolemy XIII**, then came to the throne as joint occupant with Cleopatra; but she is thought to have caused his death in 44 B. c., when she placed her son, Caesarion, **Ptolemy XIV**, on the throne as joint ruler with her. She died in 30 B. c., by her own hand, and Ptolemy was murdered. See **CLEOPATRA**.

PTOLEMY. Long before the time of Columbus, an author who lived in Alexandria advanced the theory that the earth is round. He was Ptolemy, who wrote a geography and book on astronomy in the second century A. D. Little is known of his life, but his theory of the universe, used as authority until the sixteenth and seventeenth centuries, was that the earth was the center of the solar system, that the sun and the moon revolved about the earth in unequal orbits, and the planets were the Moon, Mercury, Venus, the Sun, Mars, Jupiter, and Saturn. See **COPERNICUS**, **NIKOLAUS**; **PLANET**.

PUBLIC LANDS. See **LANDS**, **PUBLIC**.

PUBLIC UTILITIES. As the name implies, a public utility must be useful—useful to the general public which it serves. Public utilities include such enterprises as telephone, telegraph, water, gas, light, and power services, street-railway and bus lines, and railroads. Utilities may be local or interstate, and may be publicly or privately owned. Regardless of their nature, public utilities require a vast outlay of money and, in the United States, they comprise a large percentage of the national wealth.

Those utilities which are privately owned are operated under a franchise; that is, the exclusive privilege granted to a company either by a city or state to operate a public utility for a certain number of years. In America most of the public utilities are privately owned and operated. These utilities generally are monopolies, being the only industries of their type serving a given region. Unified control of utilities in a community is justified on the ground that

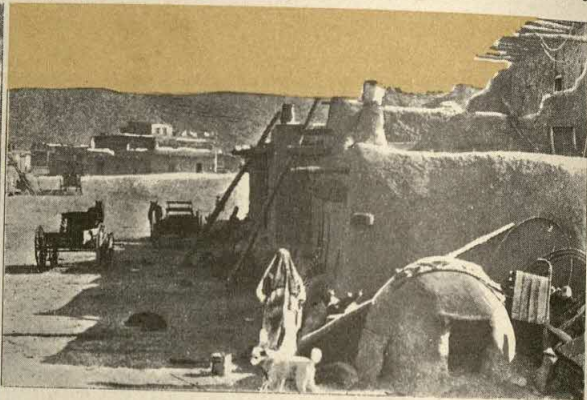
duplication of utility services is both unnecessary and uneconomical.

Since these utilities are vitally necessary to the public welfare but are in the hands of private companies organized for profit, it is essential that they be controlled by some public authority. The rates and services of utilities which serve a local market are regulated by state commissions. Utilities which are interstate in scope are regulated by national commissions. Utilities must also conform to various state and national laws which aim to prevent bad business practices.

Few utilities are publicly owned in the United States, although there is a definite trend in that direction. Most waterworks in America are owned by municipalities, but comparatively few cities own their light and power plants. The United States government is encouraging the movement by the construction of such enterprises as the Tennessee Valley project and Grand Coulee Dam. See **GOVERNMENT OWNERSHIP**; **MUNICIPAL OWNERSHIP**.

PUCCINI, *poot che'ne*, GIACOMO (1858-1924). One of the greatest of the Italian operatic composers, Puccini was born at Lucca of a distinguished family of musicians. He studied at the Milan Conservatory and completed his first opera, *Le Villi*, in 1884. His second, *Edgar*, had a poor libretto and proved a failure. His first great operatic success was *Manon Lescaut*, produced in 1893. *La Bohème*, *La Tosca*, *Madame Butterfly*, and *The Girl of the Golden West* followed in rapid succession, each a pronounced success. *Turandot*, his final operatic work, was not produced until two years after his death.

PUEBLO, *pweb'lo*. Of all the Indians who lived north of the Rio Grande River, the Pueblo were the most advanced in civilization. They dwelt in stone or adobe houses in the southwestern part of what is now the United States; they made beautiful baskets and blankets; molded fine pottery; irrigated the soil, and grew a variety of crops. In addition, they raised sheep, after the Spaniards introduced them in the sixteenth century, and wore colorful clothing.



Courtesy Santa Fe Railroad

VILLAGE DWELLERS OF SOUTHWEST

The Pueblo Indians who live near Santa Fe are noted for their beautiful pottery. Left, one of a community's kilns for firing pottery. Above, a village.

Their name comes from the Spanish word *pueblo*, meaning *village*, which the Spaniards applied to all the Indians living in such established communities. Several thousand Pueblos, representing four different language groups, still live in New Mexico and Arizona. Among these are the Zuñis and the Hopis. Although some of these short, but strong, peoples still live in their terraced, fortlike homes, most of them do not. See ADOBE; CLIFF DWELLERS; HOPI; ZUNI.

PUERTO RICO, *pwer' tuh re' koh*. Discovered by Columbus in 1493 and ruled by Spain until 1898, this colorful tropical island became a possession of the United States as a result of the Spanish-American War. Lying in the Caribbean Sea, about 1,000 miles southeast of the tip of Florida, it is one of the largest of the West Indies Islands, covering an area of more than 3,400 square miles.

A series of mountain ranges, from 2,000 to 4,000 feet high, spreads across the island in a general east-west direction. Along the coast, however, are level stretches admirably suited to farming, and numerous small harbors. Although the tropical sun shines practically every day, this sea-cooled

island has a delightful climate the year round. The average annual temperature is 78°F., with little seasonal change.

Industries and Trade. Most of the island is devoted to farming, sugar cane being much the most important crop. Other valuable products include citrus fruits, pineapples, coconuts, bananas, vegetables, coffee, tobacco, cotton, rice, cacao, and henequen. Cattle and hogs are the principal livestock raised.

Most of the island's other industries depend chiefly on its crops. They include sugar refining, coffee roasting, fruit and vegetable canning, and the making of rums, cordials, molasses, cigars, cigarettes, and rope. Other manufactures include buttons, clothing, cement, glass, shoes, paperboard, and textiles. Hydroelectric power is being developed to encourage the industrialization of the island and to provide more jobs for its people. Its first factory for making heavy machinery — commercial ice-cream freezers — was opened in 1952. In addition, the islanders continue to be noted for their handicrafts, including embroidered goods and other needlework, pottery, and hats, baskets, and other straw products. Most of the island's trade is with the United States.

Since the end of World War II, Puerto Rico has become a popular winter resort, especially for vacationists from the United

States, and fine resort hotels have been built to encourage its growing tourist trade. Visitors arrive by ship and plane to enjoy the island's mild climate, beautiful scenery, and Spanish-colonial atmosphere.

The People. Densely populated, with some 2,306,000 people, Puerto Rico has begun "Operation Bootstrap" to ease poverty and check the flow of migrants to the mainland. About one fourth of the people are Negroes; the rest are whites, mostly of Spanish descent. Roman Catholicism is the chief religion and Spanish the popular language, though most of the people also speak English. Education is free and compulsory. San Juan is the capital and largest city.

History and Government. Puerto Rico got its name from Ponce de Leon, the first Spanish governor, who in 1508 called what is now San Juan Bay "Puerto Rico" (rich port). The native Indians were killed off by the Spaniards, who brought in Negro slaves. Spain's rule became very unpopular, and the islanders refused to oppose

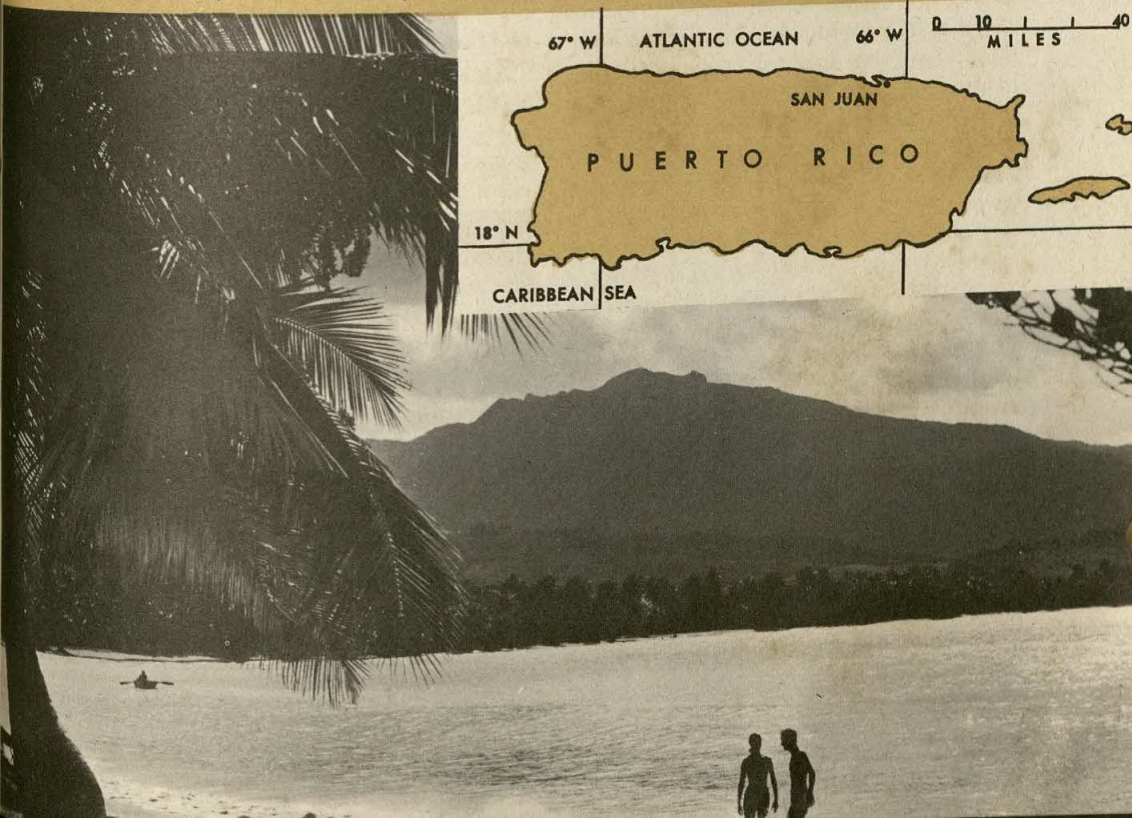
American occupation during the Spanish-American War. After the conflict, Spain ceded Puerto Rico to the United States.

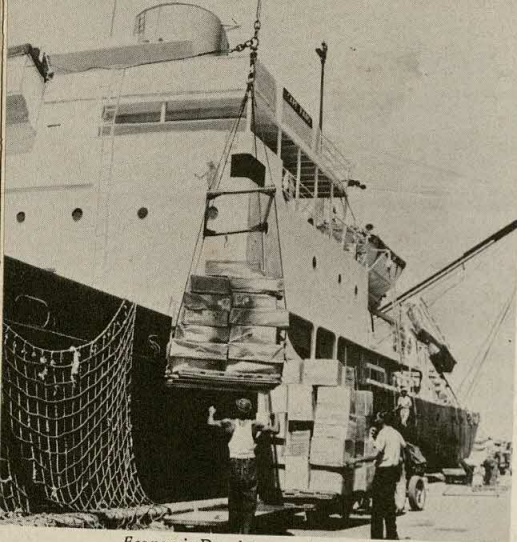
To modernize the colony, America introduced sanitation and built roads, railroads, schools, dams, and hydroelectric plants. In 1917 the colony was given territorial status, and its people became American citizens. In 1946 the island was given its first native governor; in 1947, the right to elect that official and a local legislature. Three years later, it was allowed to draft its own constitution, which was adopted in 1952. Under this, Puerto Rico is a commonwealth, governing its own internal affairs and voluntarily associated with the United States. It elects its own governor and two-house legislature. An elected resident commissioner has a voice, but no vote, in the American House of Representatives. The Puerto Rican government has worked to speed up the island's industrialization and create new jobs for its poor, generally landless people.

Government of Puerto Rico, Photo by Rotkin

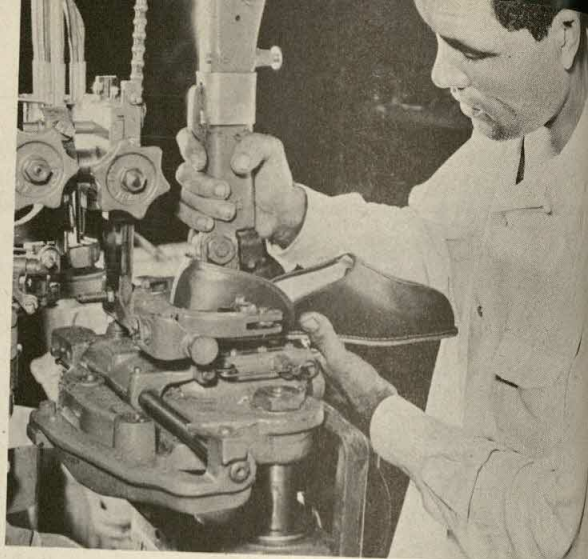
TROPICAL PUERTO RICO LURES THE TOURIST TRADE

Attracted by the island's beauty, visitors from the mainland bolster Puerto Rico's economy.





Economic Development Administration



Puerto Rico Industrial Development Co.

INDUSTRY AND TRADE HUM IN PUERTO RICO

As the result of "Operation Bootstrap," hundreds of modern industrial plants turn out more than four hundred different products for foreign markets. Except for Venezuela, Puerto Ricans have the highest income per person in Latin America.

PUFF'BALL. Like mushrooms, toadstools, rusts, smuts, and mildews, puffballs are fungi. They are, however, harmless to living plants, for they subsist entirely upon dead and decaying matter. They differ from mushrooms and toadstools in having their spores, the dustlike particles which scatter to form new puffballs, enclosed within a protective wall.

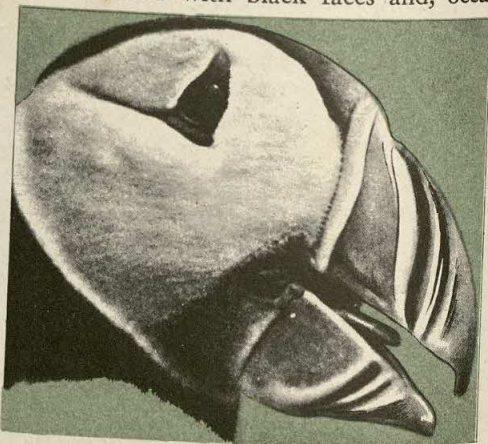
The true puffball lives underground during most of its existence, only emerging in time to mature and discharge its spores. It sometimes grows to a diameter of twenty inches, but is usually much smaller. The true puffball also has a definite opening for the escape of spores. There are, however, a number of other fungi which are generally classed as puffballs, which split open in irregular ways. Among them are the nest fungi, in which the round spore cases rest in a nestlike cup.

Many species of puffballs can be eaten. They are fried or used in salads.

PUFF'FIN. Several species of sea birds belonging to the auk family are named puffins. They are about the size of pigeons and have great, high, flattened bills which are often brightly colored in red, yellow or blue. Moreover, during the breeding sea-

son certain curious appendages appear at the base of the bill, which are later shed. In general, puffins behave like auks, except that the single large egg is laid in a burrow or hole. Puffins occur in both the Atlantic and Pacific oceans, breeding along the Arctic coasts, and migrating in winter south to Long Island and California.

PUG. More beautiful breeds have largely supplanted the small pug dog, with his snub nose and tightly curled tail. Pug dogs are sometimes black, but are more commonly fawn-colored with black faces and, occa-



THE HEAVY-BEAKED PUFFIN

sionally, a black streak down the back. They are stiff-legged little animals, best characterized by their blocky heads and curled tails. Pug dogs tend to grow fat, surly, and sickly as they grow older, and this fact, of course, does not increase their general popularity.

PULASKI, *poo lahs'ke*, CASIMIR (1748-1779). Held in high esteem by Americans for his unselfish participation in the Revolutionary War, Casimir Pulaski is acclaimed as one of the greatest Polish heroes of all time. Born of the nobility, at Podolia, he was an unquenchable foe of oppression. He first entered the Polish wars against Russia, but was soon after exiled because of his supposed implication in a plot against King Stanislaus in 1771. His property taken from him, he traveled in France and Turkey, and finally sailed to the United States in 1777, where he joined the Continental Army at Philadelphia. He was chief of dragoons at Brandywine, later being made a brigadier general. Serving at the head of a body of cavalry and infantry in the South, he was wounded while attacking the city of Savannah, October 9, 1779, and died two days later.

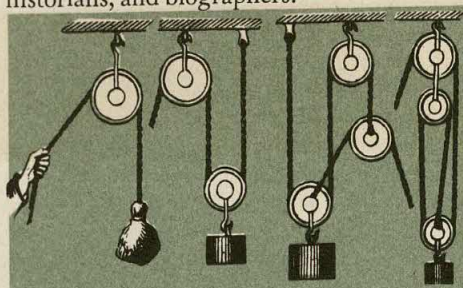
PULITZER, *pul'itz ur*, JOSEPH (1847-1911). Modern American journalism owes much of its character to the Hungarian immigrant, Joseph Pulitzer, who rose from poverty to become the outstanding editor and publisher of his day.

Born in Budapest, Pulitzer came to the United States in 1864 and served a year with the Union army in the Civil War. At the end of the war, he became a member of the staff of the *Westliche Post*, a German-language newspaper published in Saint Louis by Carl Schurz. Later, he became editor and publisher of the newspaper, served a term in the Missouri state legislature, and in 1876-77 was Washington correspondent for the *New York Sun*. In 1878 he founded the *Saint Louis Post-Dispatch*, made it the city's leading evening newspaper, and five years later bought the *New York World*.

Under the leadership of Pulitzer, the *World* assumed a commanding place in the

nation's affairs. He introduced comic strips, pictures, and special features, and performed innumerable public services by crusading for reform in government and exposing corruption.

Pulitzer, who was almost totally blind at the time of his death, amassed a considerable fortune. He left \$2,500,000 to Columbia University for the founding of a school of journalism, and his will provided for the awarding of the celebrated Pulitzer Prizes. These awards are made each year by a committee to newspapers, newspapermen, correspondents, poets, novelists, playwrights, historians, and biographers.



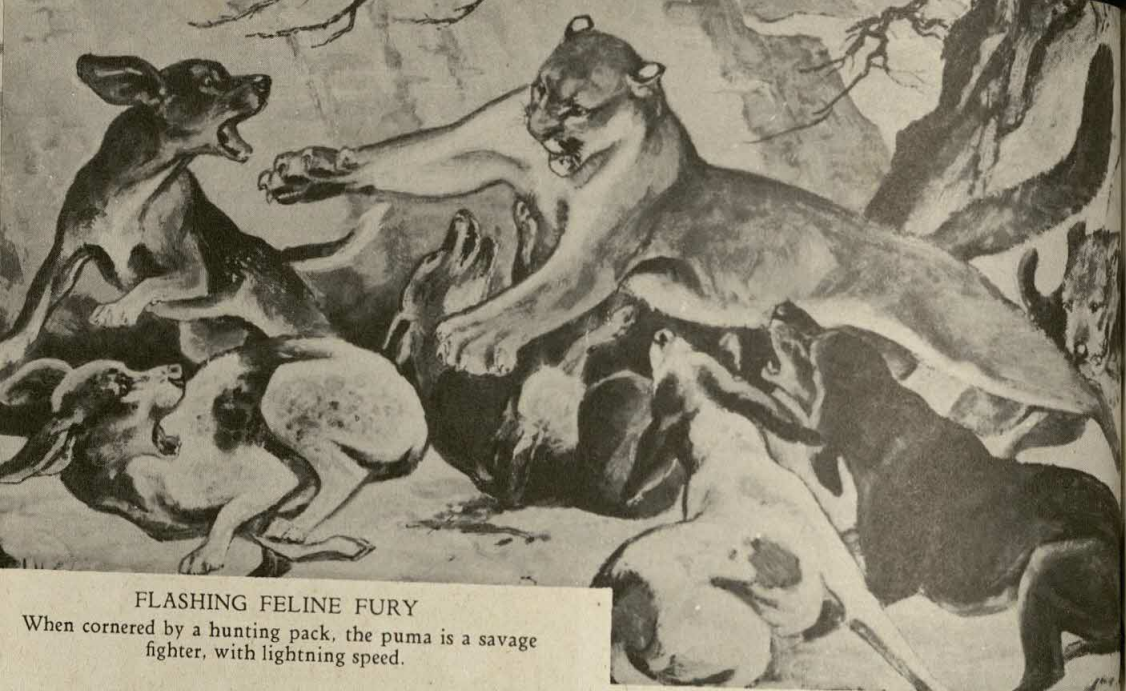
GAINING POWER WITH PULLEYS

Left to right: simple pulley, power balances weight; movable pulley added; two complex rigs.

PULLEY. In its commonest form, a pulley is a grooved wheel turning about an axle in a frame called a *block*. It has two uses, serving to change the direction of a force and to multiply the effect of a force by letting it act through a greater distance.

A set of two or more pulleys used together with ropes as a hoisting contrivance is called *block and tackle* (see **BLOCK AND TACKLE**). The advantage gained in using the block and tackle depends upon the number of pulleys in the system, and also upon the manner in which they are combined.

Where there is a movable pulley, the effectiveness of any force is multiplied. That is, the movable pulley has a mechanical advantage. If the rope is pulled two feet over the fixed pulley, the movable pulley is moved one foot. Therefore the weight that can be lifted with the movable pulley is twice as great as the one that can be moved without it. The fixed pulley merely changes



FLASHING FELINE FURY

When cornered by a hunting pack, the puma is a savage fighter, with lightning speed.

House of Seagram

the direction of the force. Of course, the efficiency of the arrangement is somewhat cut down by friction, stiff ropes, and other causes. Ordinary pulleys are sixty to eighty per cent efficient; from twenty to forty per cent of the force applied is lost.

The Endless Chain. This device, known technically as the *differential pulley*, has such great mechanical advantage that with its help a man can lift a heavy engine with one hand. It consists of two pulleys of very nearly the same size, fastened so that they turn together, and a single movable pulley. A continuous chain passes around the larger of the two fixed pulleys, then around the smaller, then around the movable pulley, and again around the larger fixed pulley. When the larger pulley is turned, to raise the load, it causes the smaller pulley, turning with it, to let out nearly as much chain as the large one pulls in. Therefore the chain must be pulled several feet to raise the load a few inches, but as a result the mechanical advantage is very large. See MECHANICAL POWERS.

PULMOTOR. Designed to revive suffocating people, victims of gas, drowning, or shock, the pulmotor is a machine for producing breathing by mechanical method. It consists of an oxygen tank, injector, mask,

and suction device. It has been displaced by the *inhalator*, which permits oxygen to flow into the lungs, instead of being forced in under pressure, and by the more complicated *iron lung*. For first-aid use, the manual method of resuscitation is recommended. See DROWNING.

PULSE, THE. Place the finger upon the radial artery in the wrist, and you will distinctly feel a regular beat. This is the place that the doctor touches when he is "feeling the pulse." In general, the pulse is the expansion of arteries caused by the contractions of the heart. When the arteries are large and near the surface, as in the wrist, the pulse is easily felt. It varies in both health and disease, being influenced by many factors, such as atmospheric temperature, posture, sex, air pressure, and fever.

The pulse rate varies from 145 beats per minute, before birth, to sixty in old age, the normal rate in adult life being about seventy-two; it is increased by exercise and diminished by repose. Much useful information is derived from observations of the pulse in sickness, especially in its relation to respiratory movements and the temperature of the body.

PULSE FAMILY. See LEGUMINOUS PLANTS.

PUMA. So destructive is the puma in the Western cattle-raising area that several states have placed a price on its head. A member of the cat family, the puma usually grows to a length of six feet or more and weighs about 200 pounds. It is also called *cougar*, *panther*, and *American lion*. The puma's body is reddish brown in color. It has light-colored throat, breast, and legs, and a dark streak running along the back. Pumas feed upon small animals such as rabbits, and are especially destructive to deer, pigs, calves, and colts. A single puma may kill a hundred sheep in a night, but would seldom dare to attack a man.

PUMP'KIN. It is difficult to separate pumpkins from squash; both belong to the gourd family. All kinds that have thick, fleshy stems (as Hubbard squash) are squashes. On the other hand, the slender, ribbed stem of the pumpkin is found on the summer squashes and on several others. A common field pumpkin would not be mistaken for a squash, but some of the sweet and pie pumpkins might fall in either class.

Pumpkins are used for stock feed, as a cooked vegetable, for pies, and for jack-o'-lanterns. See SQUASH.

PU'NIC WARS. Rome established her supremacy over the Western Mediterranean world in the Punic Wars. These three conflicts were waged against Carthage, Rome's rival in Northern Africa. The first war took place from 264 to 241 B. C. and won Sicily for the Romans. The second, lasting from 218 to 201 B. C., resulted in the conquest of Spain. The third war, from 149 to 146 B. C., completely crushed Carthage.

For additional information, consult the following articles:

Carthage	Rome
Hamilcar Barca	Scipio, Publius
Hannibal	(father and son)

PU'PA. When a caterpillar, a maggot, a grub, or any other larva reaches its full growth it changes into a pupa. In this state it usually becomes entirely inactive, often forming a protective covering which is more or less hardened and frequently is enclosed in some sort of cocoon. While in this rest-



CARTHAGE LOSES HALF HER FLEET

At Mylae, port of Northern Sicily, a Roman fleet won a decisive victory over the Carthaginian navy during the First Punic War.

ing condition the insect changes its structure entirely, and all the parts and organs of the adult insect are formed anew from the substance of the larva.

Sometimes pupae are merely hardened oval objects like small capsules. More frequently they show the outlines of the legs, antennae, wings, and eyes of the adult insect beneath the pupal skin. See BUTTERFLY; CHRYSALIS.

PURE FOOD LAWS. An old Latin saying, *Caveat emptor*—meaning “Let the buyer beware!”—was the early rule by which trading was carried on. In other words, if the buyer did not take care to examine an article carefully, he was likely to find himself cheated. In some products, such as clothing, poor material could be discovered by a shrewd buyer; but in food and drugs, often prepared thousands of miles away, the buyer had no means of determining the contents. Consequently, the United States Congress in 1906 passed the first Food and Drugs Act. The present Food, Drug, and Cosmetic Act is enforced by the Food and Drug Administration of the Federal Department of Health, Education, and Welfare. The Federal law applies only to interstate commerce, but state pure-food laws apply within the boundaries of the individual states.

Adulteration of foods may be of several types—the insertion of harmful ingredients, the withholding of wholesome ingredients, below-standard quality, unsanitary preparation, the use of chemicals for preservative purposes, and misbranding (conveying on labels misleading information).

Certain exceptions are allowed. Small amounts of aniline dyes as coloring and benzoate of soda have been found harmless, if pure. Ordinarily, however, they should not be used, as foods containing chemical preservatives are likely to be inferior. Smoke and salt, used in preserving meats, do not affect the quality of the meat. See SALT.

The same laws apply to drugs, which must meet certain standards and must be properly labeled.

PU'RITANS. Solemn, righteous, and uncompromising, the Puritans contributed noteworthy chapters to the histories of England and America. They came into prominence in England about 1564, and during the next hundred years had an important part in the internal strife waged in that country which led to the settlement of America.

The Puritans were religious reformists who were opposed to Catholic ceremonies and rites in the Church of England. Because they wished to *purify* the Mother Church, they received their historic name. At the time of the accession of James I, the Puritans were of three groups. One group held that the Church of England should be reformed; another believed that England should adopt Calvinism; while the third faction was against an Established Church, advocating instead, individual congregations that would govern themselves.

Naturally, there was great opposition to the Puritans, but they prospered under James I and Charles I, and had a leading part in the civil war which resulted in Charles' execution. In 1660, when the Stuarts were restored to the throne, the Puritans, who had been dominant during the Commonwealth, were again subject to restrictive laws, and many emigrated to America to join their comrades who had come over years earlier. See PILGRIMS; MASSACHUSETTS.

PUT'NAM, ISRAEL (1718-1790). One day in April, 1775, an elderly farmer was plowing in a field near Brooklyn, Conn., when news reached him that a battle had been fought between the Americans and British at Lexington, Mass. Like Cincinnatus of ancient Rome, the farmer, Israel Putnam, left his plow in the field to take up arms for his country. His patriotism and bravery at Bunker Hill, where he shared in the command of the American troops, brought him enduring fame.

Putnam, a native of Massachusetts, had served in the French and Indian War, and had traveled to the West Indies, the mouth of the Mississippi River, and surrounding

regions. During the Revolutionary War he was a major general, commanding the fortified lines in the Battle of Long Island, and the Highlands on the Hudson River. He was stricken with paralysis in the winter of 1779, and died in May, 1790, on the farm he had left fifteen years before.

PUTREFACTION, *pu tre jak'shun*. Fermentation of organic matter accompanied by offensive (fetid) odor is termed putrefaction. It is a process of decomposition, more common in animal than in vegetable matter, and is produced by micro-organisms like bacteria, molds, and yeasts.

Measures taken to prevent putrefaction of foods are cooking and canning, pickling, salting, smoking, drying, freezing, and pasteurization. Putrefaction of infected wounds may be prevented by the use of antiseptics. See BACTERIA AND BACTERIOLOGY.

PUTTY. Finely ground whiting (see CHALK) is mixed to the consistency of a stiff mud with linseed oil to make putty. The best putty has about ten per cent of white lead mixed with pure whiting. White lead adds hardness. Inferior grades of putty are made by substituting marble dust for the whiting and resinous or mineral oils for the linseed oil. Putty may be softened by contact with a red-hot iron.

Putty is used in glazing, or fastening windowpanes in the sash. In first-class glazing the pane is first bedded by placing a thin layer of putty in the sash where the glass rests, to serve as a cushion. The pane is then set and held in place by small, triangular-shaped zinc points, and the edge is covered with a strip of putty pressed firmly into place.

Putty is also used by painters for filling nail holes in surfaces to be painted. Putty to be used in glazing steel sash is a mastic of some bitumen, made without oil.

PYGMALION, *pig ma'le on*. According to Greek legends there once lived a great sculptor named Pygmalion. He avoided all women because none came up to his ideal. He is said to have created a statue so lovely and graceful that he fell in love with it, praying daily that it might come to life. In

answer to his prayers, Aphrodite instilled life into Galatea, his beautiful statue, who stepped down from her pedestal and became his wife.

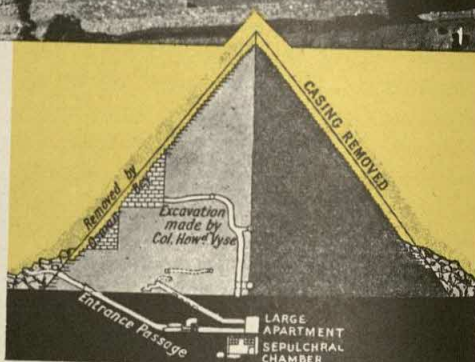
PYGMIES, *pig'miz*. Peculiar among the types of men found in the world are the pygmies, who seldom grow to a height of five feet. The pygmies of Africa, also called *Negrillos*, live in the central equatorial regions of the continent and are distinguished by their Negroid features and woolly hair. Those of Asia live on the Malay peninsula and have wavy hair. A third type of pygmies, called *Negritos*, live on the Andaman, Philippine, and other near-by islands.

PYRAMID, *pir' a mid*. Comparable to the cone, as the prism is to the cylinder, the pyramid is a geometric solid whose base is a polygon and whose sides are triangles rising to a common vertex. The pyramid is called *triangular* if its base is a triangle, *quadrangular*, if its base is a quadrangle, and so on. A triangular pyramid whose base and sides are equilateral triangles is known as a *tetrahedron*, one of the five possible regular solids.

The volume of a pyramid, like the volume of a cone, is equal to one third the area of the base times the altitude, which is the perpendicular distance from the base to the vertex. A *regular*, or *right*, pyramid is one whose base is a regular polygon and whose vertex lies on a perpendicular from the center of the base. See CONE.

PYRAMIDS. Like silent sentinels of the ages, the pyramids of Egypt have watched the endless parade of civilization almost from the time it began. Still as awe-inspiring and as renowned as they were when Greek scholars crossed the Mediterranean Sea to view them, they are considered among the wonders of the ancient world.

The pyramids, built between 3000 and 1800 B. C., presumably were tombs for Pharaohs. There are about seventy-five of these burial monuments, all built of hard limestone from the near-by hills, or blocks of granite from far-off regions. They are located within a region of sixty miles extending north and south along the west



(1) Courtesy Thomas Cook & Son
(2) Courtesy North German Lloyd

THE ROYAL TOMBS OF GIZEH

Ancient Egypt believed in the afterlife, and its rulers took elaborate means to insure the privacy and permanence of their royal tombs, the pyramids. Top, the Gizeh group, with Sphinx. Left, Cheops. Above, Third Pyramid plan.

bank of the Nile. Three of them, near Gizeh, are the most famous. As called by the Greeks, these are Cheops (Khufu), or the Great Pyramid; Chephren (Khafra), and Mycerinus (Menkauru), each named for its builder.

The Great Pyramid, largest in the world, is not so tall today as it was originally. When finished, it stood 482 feet high, and its base was 768 feet square. Theft of the stones for other buildings and erosion have reduced the height to 451 feet, and the length of the sides at the base to 750 feet. It covers an area of thirteen acres. According to estimates, it contains 2,300,000 stones placed in step formation, each step about three feet high.

Cheops, the Pharaoh for whom it was named, is said to have employed 100,000 slaves for twenty years to quarry and haul the blocks and place them in the structure.

When the pyramid was finished, a smooth stone coating was placed over the structure, but this has since disappeared. Entrance to the interior is through a passage on the north side forty-eight feet above the ground. Inside, there are several chambers, the most important of which is the King's Chamber. The entrance was sealed after Cheops had been buried inside.

Chephren is 450 feet high and the base is 694 feet long on each side. Mycerinus, the best constructed of the three, is 204 feet high and 356 feet at the base. Nearly as high, the six-terraced "Step Pyramid" at Saqqara, twenty miles south, is believed to be the oldest of man-made structures.

Mexico's famous terraced pyramids are flat-topped and lower than Egypt's, but some of them cover more ground. They were built by the Toltecs, Mayas, and other early peoples in honor of their gods. Pyramids also are found farther south in the Americas.

PYRENEES, *pir'e neez*. Rearing their lofty peaks to form a picturesque natural barrier between France and Spain are the Pyrenees, which stretch all the way from the Mediterranean to the Bay of Biscay, a distance of about 280 miles. On the French side, the slopes descend sharply, turning numerous small rivers into sparkling cascades. The highest point in the Pyrenees is 11,169-foot Pic d' Anethou. Toward their ends, however, they are much lower, and until the late 1920's the only highways and railways between France and Spain wound around the mountains. Even now, only two, many-tunneled railroads actually cross them and their few lofty passes.

Most of the colorful Basques of the Western Pyrenees are small farmers or shepherds. Hidden among the mountains is midget Andorra, one of the world's oldest republics. See **ANDORRA**.

PYRRHUS, *pir' us* (318-272 B. c.). Rome and Greece clashed on the battlefield for the first time in 281 B. c. when Pyrrhus, king of Epirus, led a force against the Romans at Asculum. The Greeks won the battle, but so costly was the conquest that Pyrrhus is

said to have exclaimed, "Another such victory and I shall be ruined." The phrase "pyrrhic victory" has ever since been used to describe a costly conquest over an enemy.

Pyrrhus became king of Epirus at the age of twelve, replacing his deposed father, but he, too, was banished in 302 B. c. He took part in the Battle of Ipsus and later went as a hostage to Egypt, where he married the stepdaughter of Ptolemy Soter. He soon returned to his native kingdom, which he regained in the Battle of Aetolia. Ambition then prompted him to conquer Macedonia, and, with Lysimachus, he won the territory, only to be driven out by his ally.

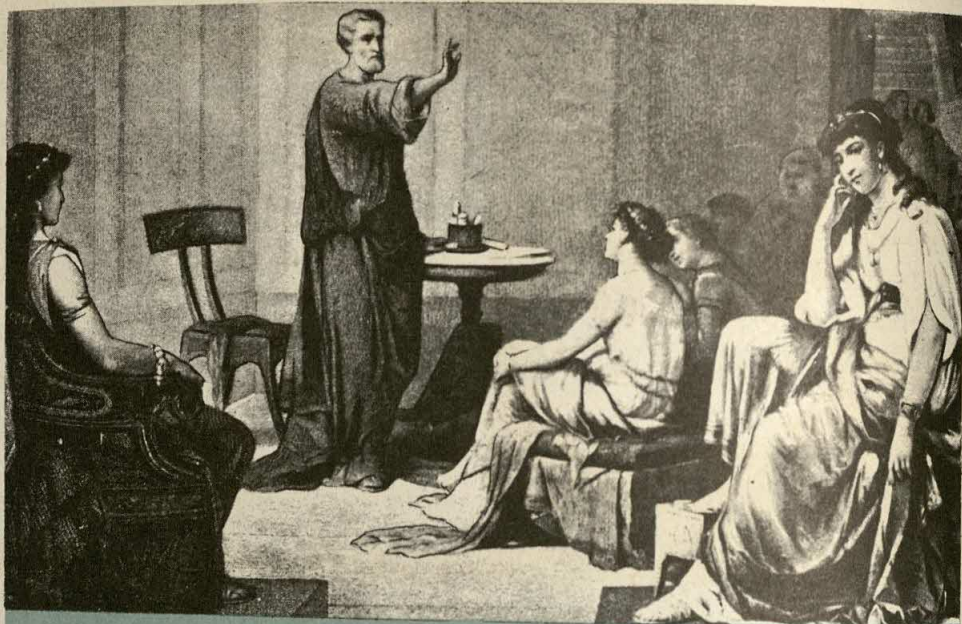
Following his "victory" over the Romans, he aided the Sicilian Greeks in their struggle against Carthage. Defeated, he returned to Greece, where he died in 272 B. c.

PYTHAGORAS, *pith ag' o ras* (about 582-after 507 B. c.). First to believe that the earth is round, Pythagoras, a Greek philosopher and mathematician, developed a theory of the world that was not proved for 2,000 years. He and his followers, called Pythagoreans, also believed in the transmigration of the soul and originated the geometrical proposition that the square of the hypotenuse of a right triangle is equal to the sum of the squares of the other two sides.

Pythagoras is thought to have been born in Samos, and it is believed that he traveled widely throughout the Mediterranean. About 529 B. c. he settled in Crotona, Italy, where he founded the philosophical brotherhood which bore his name.

The Pythagoreans believed in simplicity, temperance, obedience, and self-restraint in the conduct of their daily lives and devoted much time to the study of numbers. The brotherhood also is said to have developed the theory of the solar system. An uprising of the people against the Pythagoreans resulted in the death of many of the group, possibly Pythagoras.

PYTHIAN, *pith'i an*, **GAMES**. Celebrated in honor of Apollo every four years, the Pythian Games attracted the finest athletes, artists, musicians, poets, and scholars



A BRILLIANT AND BEAUTIFUL STUDENT

Under tutelage of Pythagoras, Theano distinguished herself in philosophy, later wed him.

in Greece. They were held at Delphi the year before the Olympic Games, and to be crowned a winner in one of the competitions was almost equal to the honor of being an Olympic champion.

The games at first were held every nine years, but in 586 B. C. they were taken out of the hands of the priests of Delphi and managed by the Amphictyons, who conducted them every four years. Prizes of silver and gold were the rewards at first, but later winners were given laurel wreaths. Contests included those in athletics, music, horse and chariot racing, painting, sculpture, and other scholastic and artistic accomplishments. The games were held regularly until the fourth century A. D.

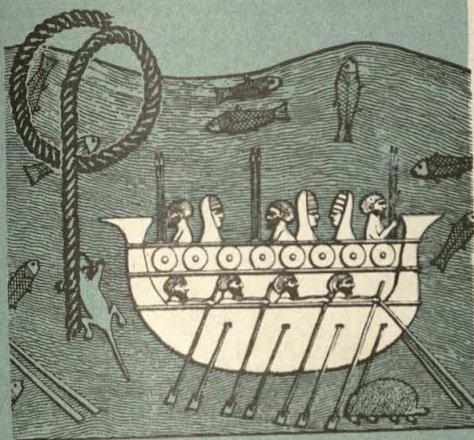
PYTHIAS. See DAMON AND PYTHIAS.

PYTHON. The snakes usually handled by snake charmers who make their living by handling large snakes are the non-poisonous pythons that belong to the same family of snakes as the boas (see BOA). A python, like a boa, kills its prey by squeezing it to death. It then swallows the killed animal or bird whole. Some pythons reach a total length of over twenty feet, which

partly explains their amazing strength. The regal python of Asia is the largest of the pythons; it has been reported to reach a length of thirty feet. The *rock* python, of Africa, is smaller, and the python of Australia still smaller. The Australian form is only about six feet long when mature. The pythons of Australia, like the anacondas of South America, live near the water.

One python lays from fifty to one hundred gray eggs. The female piles these eggs into a cone-shaped heap and winds her body about the cone, with her head at the top. Here she remains until the eggs hatch, even though the hatching period may be nearly two months. The young are able to care for themselves within two weeks after they are hatched. See SNAKE.

PYXIE, pik'si, FLOWERING MOSS, or PINE BARREN BEAUTY. From the sandy New Jersey soil southward along the Atlantic coast grows the lovely, starry-flowered pyxie, a beautiful, early spring plant. It grows in the form of a creeping, cushion-like shrub, and bears tiny evergreen leaves which are almost concealed by the mass of pink buds and white flowers.



Q. Helpless because it cannot stand alone, and useless because its pronunciation is duplicated by other letters, Q survives from Phoenician times as the seventeenth letter in the alphabet. In modern English it is always followed by *u* and must be supported by that letter. The Phoenician name for it was *koph*, and it was written Φ . The Western Greeks wrote it φ , but the Eastern Greeks had no character for it. In fact, the Greeks had no use for Q because they had no distinct sound for it, as the Phoenicians had. But the Romans revived the letter, writing it as we do today and following it by *u*.

QUAIL, *kwale*. In North America the quails include a number of game birds known by various names. The best known is the *bobwhite*, whose peculiar cry suggested its name. This bird is also called *partridge* in the South. In the Southwest and West are the *mountain quail*, *California quail*, and the *scaled quail*.

The bobwhite, a handsome bird in various shades of brown, black, gray, and white, ranges principally in the eastern part of the United States from Canada to the Gulf of Mexico. Nearly a foot long and very plump, it lives on or near the ground and feeds on berries and seeds. It nests in the long grass, laying from ten to eighteen eggs. The California quail is distinguished by a feathery crest.

The flesh of quails has an excellent flavor and is much in demand as a table delicacy.

QUAKERS, or SOCIETY OF FRIENDS. Founded in England about 1648 by George Fox, the Quakers, a Christian religious group, comprise some 113,000 members in the United States. They received their name because of George Fox's stirring demand that they "tremble at the word of the Lord." Originally, they dressed very simply and used "thee" and "thou" in their daily conversation. Al-



THE CHEERFUL BOBWHITE
Due to the efforts of conservation agencies quail are being stocked in country coverts.

though few members now follow the old-time customs, the Friends still retain the basic principles of their original Society.

The Quakers have no ordained ministers; each member of the congregation speaks in the meetinghouse as he desires. They ob-



HAND-QUARRYING VERMONT'S FINEST WHITE GRANITE
Cutting away a giant block of stone before hoisting it to the surface—it's hard and dangerous work. Above, right, boring holes in solid Pennsylvania slate with a pneumatic drill.

serve neither the Lord's Supper nor baptism, and the only holy day which they keep is Sunday. At all meetings Quaker men and women sit on opposite sides of the hall. Quakers refuse to take oaths of any kind and object to any war, whether it be justifiable or not. Their churches are governed by the congregation, which decides all questions of discipline and management.

Quakers began migrating to the United States soon after the founding of the sect, because of frequent persecutions in Europe. In 1827 the American Quakers divided into two groups over the religious views of Elias Hicks, and many of the members became Hicksite, or Liberal, Quakers. Today, over half of all United States Friends belong to the Five Years Meeting, a confederation of sects formed in 1902.

QUARRY AND QUARRYING. A quarry is an open excavation from which stone is taken for building or engineering purposes. The process of removing the stone is called quarrying. There are three distinct processes or methods of removing stone, namely, by hand tools, by explosives, and by channeling and wedging. The best method to be employed in a particular case depends to a considerable extent upon the class of rock to be quarried and its availability. In general there are two classes of rock, the stratified and the unstratified. The stratified rock, as the name implies, lies in definite strata, and advantage is taken of this peculiarity in quarrying processes. The unstratified rock, although it has a cleavage line, has no definite stratification and requires a different method of quarrying.

Hand quarrying, as usually done, consists of drilling a series of holes along the line where it is desired to break the rock, then breaking the rock by means of plugs and wedges, or the so-called *plug and feather method*. The plug consists of a narrow wedge with two flat sides, and the feathers consist of wedges which are flat on one side and rounded on the other. Two feathers and one plug are put in each hole in the series of holes which have been drilled into the rock. When each plug is tapped consecutively with a hammer, an enormous breaking pressure is exerted upon the rock and tends to cleave it along the line of holes.

In the explosive process, use is made of the shattering effect of high explosives. These are placed in holes drilled along the line of breakage.

The channeling and wedging process makes use of mechanical equipment which cuts a channel along the line on which it is desired to break the rock in both vertical and horizontal lines. Channeling machines are made in a variety of forms to suit the different types of rock to be quarried.

After the rock has been broken loose from the quarry, it is shaped by various methods into the desired form. Many quarries prepare stone for building purposes, and others ship it in a crude state, to be dressed by the purchaser. Quarried rock is also used for tombstones and markers of various other kinds. Stone is also quarried in rather large quantities and broken up into small fragments for the making of concrete structures and roads.

For additional information, consult the following articles:

Blasting	Granite
Building	Limestone
Dynamite	Marble
Explosives	Sandstone

Slate

QUART, *kwort*. In the English system of weights and measures there are two separate units of capacity that bear the name quart. The first is the *liquid* quart, equivalent to two pints, or one fourth of a gallon, or 57.75 cubic inches, or 0.946 liter. The second unit is the *dry* quart, equivalent to

one-thirty-second of a bushel, or 67.2 cubic inches, or 1.101 liters. It is also divided into two pints. In Canada the Imperial quart, both liquid and dry, is equivalent to 69.318 cubic inches, or 1.136 liters. See **WEIGHTS AND MEASURES**.

QUARTZ, *kworts*. The beautiful crystalline formations which ring warm pools and springs are generally composed of quartz, a very common, hard mineral which is found in nearly all rocks and which resembles glass. In a pure state, quartz is either in the form of six-sided prismatic crystals which taper to a blunt point on the end, or in the form of small, milky-white or glassy grains. Colorless quartz is known as *rock crystal*, and is frequently used in making ornaments and lenses for glasses, while colored quartz forms semi-precious gems such as rose quartz, amethyst, or the false topaz. A non-crystalline form of quartz is chalcedony, varieties of which are agate, onyx, jasper, carnelian, and sardonyx.

Quartz occurs in gneiss, granite, limestone, and all the sands and sandstones, and is found in a wide range of colors. It is used in making abrasives, ornaments, glass, mortar, precision instruments, and vacuum tubes, in reducing metals, and in the electronic field.

QUEBEC, *kwe bek'*. To the visitor, the Canadian province of Quebec seems to be a portion of the Old World that has been transplanted, for here the largest part of the population are people of French descent who have maintained their language, customs, religion, and laws for more than three centuries. The French settled the province in the seventeenth century, and since that time it has been almost a separate country within Canada.

Quebec is situated in the eastern part of Canada. Its northern boundaries are Hudson Strait and Labrador; the southern limits are New York, Vermont, New Hampshire, and Maine. To the west are Hudson Bay and Ontario; to the east, New Brunswick and the Gulf of Saint Lawrence. The area of Quebec is 594,860 square miles. It is



Canadian Pacific Railway; Canadian National Railways

TALL BUILDINGS AND TALL TREES IN HISTORIC QUEBEC

Above is the skyline of the city of Quebec below, sap is collected for making maple sugar.



chain of mountains to the south.

The Saint Lawrence River cuts through Quebec, and, with its tributaries, drains much of the province. The development of Quebec has been due largely to the Saint Lawrence, which is navigable for the largest ships. In the northern part of the province, there are numerous rivers which flow into Hudson Bay and Ungava Bay. There are also many lakes in Quebec.

Climate. The far-northern sections of Quebec have severe winters and short, cool summers. But in the southern sections the winters are long and cold and the summers warm.

Natural Resources. Quebec has abundant deposits of asbestos and furnishes most of the world's supply. Copper and gold are very important, too. There are also supplies of magnesite, zinc, silver, graphite, lead, mica, feldspar, granite, and marble.

The fisheries are of great importance, the principal catches being cod, herring, salmon, mackerel, and lobsters.

Almost 260,000 square miles of Quebec are forest-covered and produce valuable commercial timber. A large portion of the timber is used in making pulp and paper.

Farming and Manufactures. About half the people are engaged in farming, which is restricted to the region south of the plateau, particularly the river valleys. The

the largest of all the Canadian provinces.

Features of the Land. Quebec has three main geographic regions. The region of the Saint Lawrence River is, for the most part, low, level land. North of this region is the rocky, undulating Laurentian Plateau. South of the Saint Lawrence lowlands is a hilly and, in places, mountainous region which is an extension of the Appalachian

leading crops are clover, hay, oats, potatoes, barley, buckwheat, peas, corn, and flaxseed. Tobacco is raised extensively in the Saint Lawrence region; and apples, plums, and other fruits are produced in the eastern portions of the province. Dairying and live-stock raising are important occupations.

Quebec ranks second among the Canadian provinces in the value of manufactures. Many factories are built on the banks of streams that furnish water power. The most important industry is the manufacture of lumber products and pulp and paper. Packed meats, cotton and woolen products, cigars and cigarettes, flour and flour products, boots and shoes, railway stock, and rubber goods are other important products.

Trade and Transportation. Most of the trade of Quebec is carried on with the United States and Great Britain. The cities of Quebec (the capital) and Montreal are the chief commercial centers. Exports include lumber, cattle, dairy products, and

manufactured goods. The Saint Lawrence River is the chief means of transportation for Eastern Quebec. There are also nearly 5,000 miles of railway in Quebec.

The People and Their Government. Most of the people of Quebec are of French descent, and only in Montreal and in the extreme southern portions is English generally spoken. The majority of the people are Roman Catholics. The population is over 5,000,000.

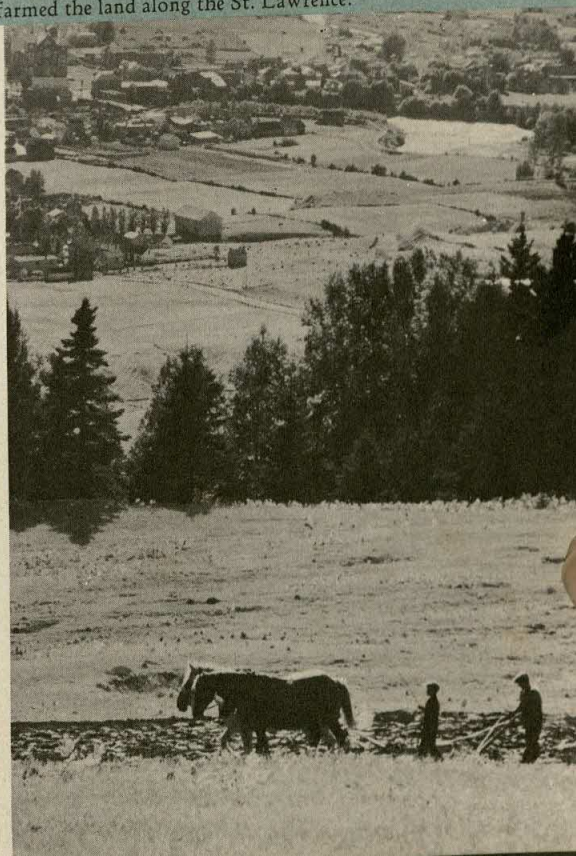
A lieutenant-governor is appointed by the Canadian government, but executive power is actually held by the premier, who is leader of the majority party in the legislature. The lieutenant-governor appoints members to the Legislative Council for life; members of the Legislative Assembly are elected for five years.

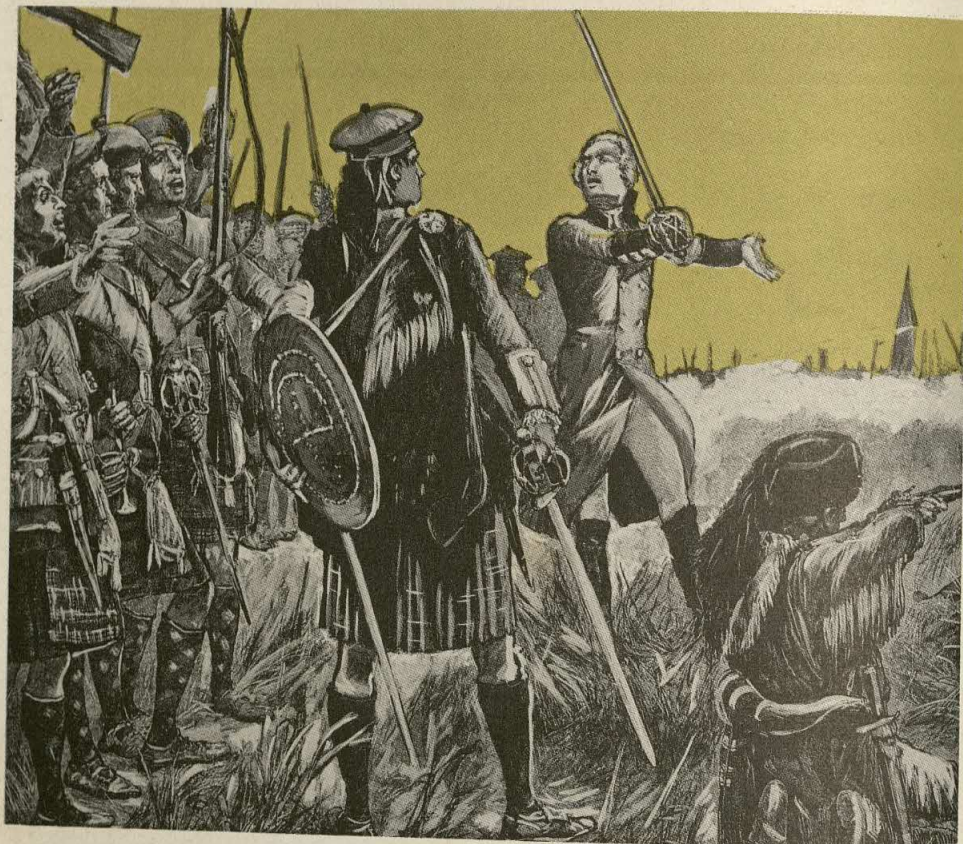
History. The first white man to visit Quebec was Jacques Cartier, who arrived in 1534. Champlain founded the city of Quebec in 1608. For many years few per-

National Film Board of Canada; Service de Cine-Photographie, Province de Quebec

OLD QUEBEC — QUIET FARMS AND FISHING VILLAGES

The beauty and charm of the village of Percé on Gaspé Peninsula attract crowds of tourists. Generations of French-Canadians have farmed the land along the St. Lawrence.





WHEN THE BRITISH WON CONTROL OF A CONTINENT

Wolfe's victory at Quebec ended French hopes of colonizing North America.

manent settlements were made because the French were more interested in fur trading than in colonization. In 1763, when all Canada was ceded by France to England, Quebec became a British province (see FRENCH AND INDIAN WARS). Ontario and Quebec, hitherto joined together, were separated in 1791 and called Upper Canada and Lower Canada, respectively. Fifty years later they were again united under one government, but in 1867, with the founding of the Dominion, they were made separate provinces. See MONTREAL; QUEBEC, CITY OF.

QUEBEC, BATTLE OF. French control of Canada came to an abrupt and conclusive end in the Battle of Quebec, fought on September 13, 1759. This battle ended the French and Indian Wars, gave England control of North America, and brought the

struggle for empire to a definite close.

The leader of the British forces was General Wolfe. He came up the Saint Lawrence River and camped on the eastern bank of the river, directly across from the sheer cliff on which the city of Quebec is situated. The French, led by Montcalm, believed themselves safe from attack because no army could scale the cliff.

But Wolfe, on the dark and moonless night of September 12, 1759, crossed the river a few miles above the city, ascended to the Plains of Abraham by way of a dried-up river bed, and in the morning had a force of nearly 5,000 men ready to throw against the French. The battle was short, taking place on the plain, and victory went to the English, but both commanders were slain.

National Battlefields Park at Quebec now covers the site of the last struggle for the control of North America. See FRENCH AND INDIAN WARS.

QUEBEC, CITY OF. Situated on a high promontory that juts out from the north bank of the Saint Lawrence River is Quebec, the oldest city in Canada and the capital of the province of Quebec. The promontory, called Cape Diamond, is formed by the junction of the Saint Lawrence and the Saint Charles rivers. Jacques Cartier is said to have given the promontory the name when he sailed up the Saint Lawrence in 1535. As he passed the bluff, rising over 300 feet above the river bank, he exclaimed, "Quel bec!" ("What a beak!"). Quebec occupies not only the promontory but also the lower land at its base; consequently it is divided into upper and lower towns. The city lies 780 miles up the river, southwest of the Strait of Belle Isle, and 180 miles northeast of Montreal. It has a population of about 310,000.

In the lower town at the foot of the cliff are the railroad yards, the river wharves, and the wholesale district. The upper town contains the retail business houses and the residential sections. The bluff is enclosed by a high wall and here is the citadel, covering forty acres, a strong fortification that played an important part in the French and Indian Wars. Southwest of the promontory are the Plains of Abraham, where was fought the decisive battle between the French and English (see QUEBEC, BATTLE OF).

Quebec is a picturesque city because of its many old buildings and winding streets. In many respects it resembles a European city. The outstanding public buildings are the houses of parliament, the customhouse, the city hall, the armory, and the post office. The city has a number of famous churches, among them the Basilica, Notre Dame des Victoires, the Catholic Cathedral, the Anglican Cathedral, the United Church of Canada, and Saint Andrew's Presbyterian Church. One of the outstanding buildings is the Chateau Frontenac, a hotel built on

the promontory. Laval University is world-famous.

Although the site of Quebec was discovered in 1535, the first settlement was not made until 1608 by Champlain. The French held the city until 1629, when it was taken by the English, but the French regained it three years later. Quebec was the headquarters of the French forces during the French and Indian Wars. The English gained permanent possession of it in 1759. At different times it has been the seat of the Canadian government. The growth of the city has been stimulated by the large foreign trade that is carried on from its port. It is also an important railroad center, with lines running to points in the United States and to all parts of Canada.

QUEBEC ACT. Passed in 1774 by the British Parliament for the government of the colony of Quebec, the Quebec Act replaced the provisional government set up by the British in 1763 and remained in force until the Constitutional Act of 1791. The Quebec Act restored the French Civil law and had many provisions protecting the civil liberties of the French-Canadians. However, because it extended the boundaries of the territory to include land claimed by the American colonies and because of certain religious provisions, it angered the Puritan and Anglican colonists of America, and was one of the British acts that was influential in bringing on the American Revolution of 1775.

QUEBEC RESOLUTIONS. See BRITISH NORTH AMERICA ACT.

QUEEN. When a queen is the ruler of a country in her own right, she is known as the *queen regnant*; but when she is merely the wife of a king but not herself the ruler, she is called the *queen consort*. A queen regnant has the powers, duties, and political standing of a king; but the queen consort, although she is the first woman of the kingdom, is legally the sovereign's subject. The mother of a reigning king is called the *queen mother*; the widow of a king is a *queen dowager*. Neither has any ruling power.

QUEEN ANNE'S WAR. See FRENCH AND INDIAN WARS.

QUETZAL, *ket sahl'*. A magnificently colored emerald and scarlet tropical bird, the quetzal is a member of the trogon family and lives in Central America. About the size of a magpie, this bird is a bright green on its head, crest, throat, and chest; the lower parts are scarlet. Its feet are too small to be of use in walking. The male is more brilliantly colored than is the female and also has sweeping tail feathers about three and a half feet long. Living deep in the forests, the quetzal feeds on fruit, lizards, worms, and insects, and lays its eggs in decaying stumps.

QUICK'SAND. On some coasts and occasionally at the mouths of rivers there are areas of what seem to be firm, damp sand but which are really loose masses of *quicksand*. That name has reference to one meaning of *quick*—*shifting* or *moving*. These sand areas contain so much water that their grains yield readily to pressure, as a fluid does. The mobility of quicksand makes it impossible for an object of any weight to be supported on its surface, so that animals and men walking upon it usually sink, leaving no trace of their disappearance. If, as soon as a person realizes the presence of quicksand, he lies down on his back and does not struggle, he will not sink.

Quicksand also presents difficulties in many engineering projects, so that where it is encountered it is usually necessary to use a large steel cylinder, or *caisson*, such as men work in when laying foundations under water.

QUICK'SILVER. See MERCURY.

QUINCE, *kwins*. Closely related to the pear and the apple, the quince is a fruit much prized for preserves and marmalades. The golden-yellow pulp is inedible unless cooked. Native to Asia, but now extensively cultivated in both Europe and America, the quince is hardy but will not thrive where the climate is too hot and dry, nor will it flourish in very cold temperatures. It is grown in America throughout the South and as far north as New York. The quince

tree, small and bushlike, is a member of the rose family.

QUININE, *kwine*, or *kwineen'*. For centuries, the only known remedy for malaria was this bitter, white, powdery drug, whose sole source was the bark of the cinchona tree. During World War II, however, when the Allies were cut off from the chief cinchona-producing areas, American chemists produced quinine from coal tar or petroleum, and atabrine, a synthetic drug, was used as a substitute for quinine. Later, several other laboratory-produced drugs also proved to be effective in combating malaria. Quinine is still widely used in treating malaria, headaches, influenza, colds, and other ailments. It should be taken only as prescribed by a physician. See CINCHONA.

QUIRINAL, *kwir'i nal*. Named for the war god Quirinus, the Quirinal is one of Rome's Seven Hills. The Quirinal Palace, begun there in 1574, now serves as the home of Italy's President.

QUOTATION, *kwotashun*, **MARKS.** Important in punctuation are quotation marks, symbols used before and after certain expressions to aid in making the writer's meaning clear. Double marks are used except where a quotation occurs within a quotation, when single marks are used for the inside quotation. The first set of marks consists of inverted commas; the second, apostrophes.

The most frequent use of quotation marks is to set off a direct quotation: John said, "I am here." The mark of punctuation at the end of a quotation appears outside the quotation marks when the meaning demands that position, as when a quotation is a part of a question: Who said, "Don't give up the ship"?

When quoting long passages or poems, use quotation marks at the beginning and end of the entire quotation and at the beginning of each new paragraph or stanza.

In some typographical styles, quotation marks are used to set off technical or slang terms, phrases which have a special meaning, foreign words, and article titles.



R. A *P* with a tail best describes the letter *R*, eighteenth in our alphabet. *R* is a heritage of the Phoenician alphabet, in which it was used as a symbol of the head of a man. The Phoenicians wrote it **4**, a form adopted by the early Greeks, who wrote from right to left. The later Greeks, writing from left to right, turned the letter around and wrote it *P*. It was the Romans who added the tail and wrote the letter *R* as we do today.

RABBI. Somewhat similar in function to the priests and ministers of Christian Churches are the rabbis of the Jewish faith. In both reform temples and orthodox synagogues, the rabbi is the leader in prayer, and in many Jewish communities of Europe he is the secular leader as well. The title came into use shortly before the birth of Christ and was applied to all religious teachers.

RABBIT. Throughout the world a familiar sight is the rabbit, a swift, cunning animal that gives man only fleeting glimpses of its downy body. Rabbits differ from hares in their smaller size and in certain other characteristics (see **HARE**). The gray rabbit, or *cottontail*, is found almost everywhere in the United States, Mexico, and Central America. It makes its home in hedges, cornfields, brush piles, and in deep grass, living on grain, garden vegetables, and the bark of trees. Such rabbits often wreak havoc with a young fruit orchard. Although its fur blends perfectly with grass, the cottontail is easily tracked in the snow, and is a favorite with the small-game hunter.

Rabbits are extremely prolific, often producing several litters during the spring and summer months. They grow rapidly and make excellent pets. At the age of six months, most rabbits are considered grown, and begin raising families of their own.

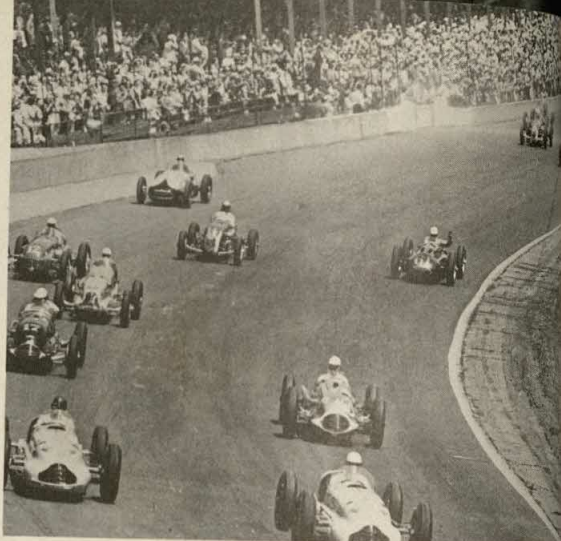
Rabbit raising may be made a profitable business, for the flesh of young rabbits is a well-flavored food. Rabbit skins are valuable to the fur industry, being made into coats under such trade names as Northern Seal, Mendoza Beaver, Lapin, and Dyed Coney.

RACCOON, *rak oon'*, or **COON**. Quaint and interesting to an unusual degree are these flat-footed, stout-bodied, grizzled, gray animals. The average length of raccoons is two and one-half feet, and they weigh from twenty to twenty-five pounds. They are widely distributed throughout wooded regions along streams and marshes of the United States and in parts of Canada.

Though awkward in appearance and lumbering in gait, raccoons readily climb up the trunks and through the treetops. Their facial expression is usually one of bland curiosity, and they peer out with a grotesque puzzled look at anything which has disturbed them. They use their front paws freely as hands in feeding and, aside from their curious habit of washing food in water before partaking of it, they resemble bears in food habits, feeding on wild berries, grapes, insects, reptiles, frogs, muskels, fish, small mammals, and upon birds and their eggs, including poultry. Their indiscriminate slaughter of fowls and their greedy appetite for green corn frequently



Courtesy of ANSCO



UPI

THE RACE IS NOT ALWAYS TO THE SWIFT

Frequently, headwork is the deciding factor. Above left, racing yachts maneuver to take full advantage of breezes. Above right, accidents and mechanical failure take a heavy toll in the Indianapolis 500-mile race. Below, a fast horse is often "boxed in" at the rail.



UPI

arouse the just wrath of the farmer. Raccoons are easily tamed and make interesting, mischievous pets.

RACE. The surest and most effective means of determining the superior contestant in a competition is a race. In athletics it takes the form of running, hurdling, and swimming competitions. Races also are held for rowboats, canoes, sailboats, and motorboats and for horses, dogs, automobiles, bicycles, airplanes, and balloons. In any race there must be definite rules regarding the start, the course, handicaps, and places, and all must know how the race is to be judged and timed and what rewards are to be given.

Running races range from fifty yards to the marathon of more than twenty-five

miles, the shorter races being held on straightaways and most of the longer ones on oval tracks. Cross-country races and marathons are held on roads and across fields. All running races are timed with stop watches, and points are awarded for first, second, third places, and so on. Handicaps are given in the form of time allowances or head starts. Swimming races may be from forty yards to distances of fifteen or twenty miles, and are held in pools, lakes, or rivers. The rules governing them are similar to those in track races.

Boat races are usually held in the form of regattas. They may be canoe races between two points, river races between sculls of one to eight men, or sailboat races which are held on a triangular course or between two points. Handicaps are based on the rig of the boat, the size, the type of boat, and other features. Speedboat and outboard-motor races are also held on triangular courses.

Horse races are universally popular, being held at large, oval tracks where thousands of dollars may be wagered on a single race. Flat racing is the commonest, two of the most publicized competitions being the English Derby and the Kentucky Derby. Steeplechase and trotting races also are spirited competitions. Handicaps are according



Some anthropologists classify the various races just by skin color. Others use the shape of the head, eyes, and lips, and the texture of the hair. Above, left, a Zulu woman of Africa with wide flat cheeks and full lips; center, a Bedouin man of North Africa, descended from white stock; right, a Japanese woman with olive-shaped eyes.

Malvina Hoffman bronzes, Chicago Natural History Museum

to the jockey's weight, and the races are electrically timed. In case of close finishes, photographs are taken, the camera being operated by an electric-eye device.

Famed for its thrills is the annual 500-mile Memorial Day automobile race held at Indianapolis on May 30. More than 100,000 persons witness the spectacle of daring drivers at the wheels of the tiny, fast motorcars whizzing around the two-and-one-half-mile, oval track. In this famed race all drivers are bound by rules set each year regarding motors and the amount of gasoline they may use. Qualifying trials are held previous to the race. There are many dirt-track races, too, and midget auto racing has become a popular indoor feature. The major automobile races are timed by electrical devices, upon which the judges base the awarding of prizes.

Bicycle road races are extremely popular in Europe and are also held by a number of cycling clubs in America. Six-day pro-

fessional races of international character are a regular sporting feature at the large indoor stadiums of Europe and America; the winners are determined by the number of laps they have been able to "steal" from their competitors and the total number of points amassed in sprints, if the teams are tied in laps.

Airplane races are held at various air shows. Special classes of planes take part in closed races; other races are open to all types. The planes usually race around a triangular course and are timed electrically. The Bennett international balloon race attracts competitors from all over the world. There is no course in this race, the balloons sailing whichever way the wind blows them. The balloon traveling the greatest distance wins. See **ATHLETICS**.

RACES OF MEN. Scientists have continually striven to classify mankind into divisions, called races, but at no time have they been able to agree. The reason is that

no one group has characteristics peculiar to it alone, although there are differences arising from climate and other factors. The word *race* also has caused confusion, for it is a term used to describe groups as small as a nationality and as large as mankind.

Yet we know that all men are not alike. It is obvious that the Negro of Africa differs in a number of respects from the Nordic of Scandinavia, and the Mongolian of Asia differs from the Semite of Arabia. Linnaeus, the eighteenth-century biologist, divided mankind into four groups based on the color of skin. His races were: European, Asiatic, American, and African. Later scientists added a fifth group, the Malayan. Blumenbach, at the beginning of the nineteenth century, also based his classification primarily on skin color, calling his races Caucasian, or white race; Mongolian, or yellow race; Malay, or brown race; Negro, or black race; and American, or red race.

This grouping has not satisfied other men of science. Some have grouped man into three great divisions: Mongoloid, including all people of Mongol origin; Negroid, including all those of Negro origin; and Caucasoid, including all those of Caucasian origin. Others, using special characteristics, such as color of the eyes and nature of the hair, and shape of the nose and head, have found a larger number of groups.

RADAR, *rad'ahr*. One of the most ingenious of the electronic marvels, radar uses radio waves to detect the presence, and to determine the exact location, of distant objects. The term comes from "Radio Detection And Ranging." Since the waves can penetrate fog, smoke, rain, clouds, and darkness—can "see" objects the human eye and ear cannot detect—it is superior to any telescope or listening device invented earlier.

Ultra-high-frequency waves are sent out from a radio transmitter. These waves travel with the speed of light (nearly 186,300 miles per second). When they strike an object, they are reflected to the set's receiver. Knowing the speed of the waves, the radar operator can estimate

the distance of the object by measuring the time the wave took to go out and return. The apparatus also records the speed and direction of the object.

In 1946 the United States Army Signal Corps made man's first radar contact with the moon, only 2.4 seconds being required for the beam to reach it and return. Some sets, however, can send waves only a few feet. Radar can also accurately measure time by tiny fractions of a millionth of a second.

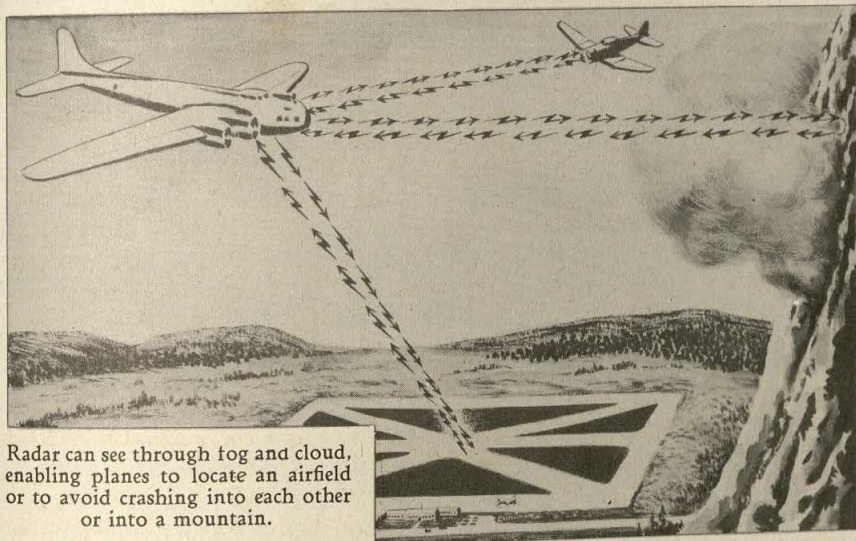
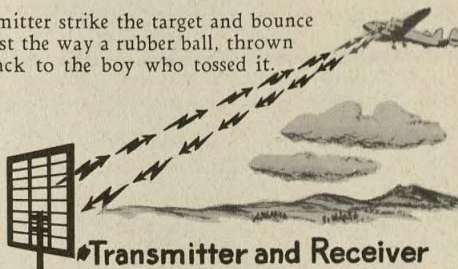
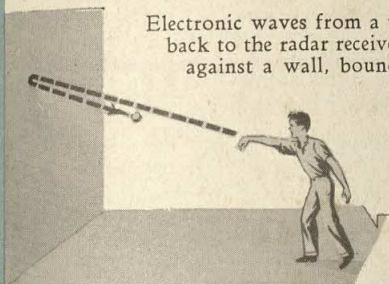
Radar dates from 1922, when it was discovered that an object moving in the path of radio waves interfered with reception. Three years later it was found that the surface of an object would reflect such waves. These discoveries put transmitter and receiver into one apparatus. By 1930, plane signals were received by radar; by 1934 distance was measured. It was not until World War II, however, that this electronic "eye" was put to practical use.

During that war, radar was of tremendous value in detecting approaching ships or aircraft. It enabled the British, for example, to know when Germany's bombers were coming—and in time to send their planes against the invaders. It helped United States forces to locate, and so drive off, the enemy submarines that harassed the nation's coasts. Radar is also enormously useful as a target-finder for guns, bombs, guided missiles, and jet warplanes. Today, a huge radar "fence" guards the coasts of the United States and Canada, and these nations have built a giant "screen" across the Arctic. Various other countries have similar defenses.

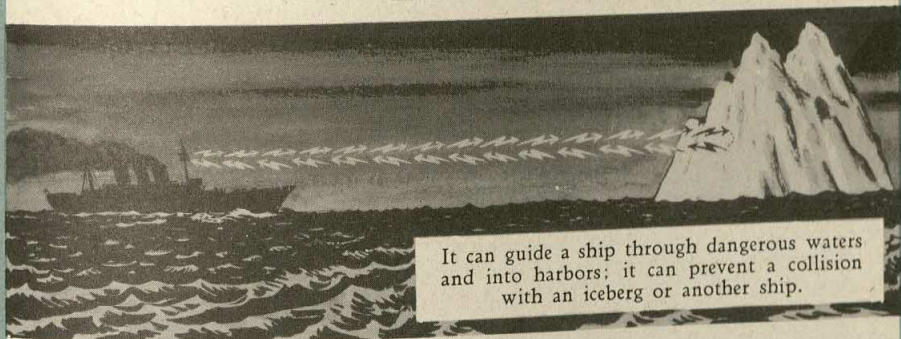
In peacetime, as well as wartime, radar enables planes and ships to avoid collisions with other craft in any kind of weather and even at night. With its aid, mariners can detect, and so avoid, hidden reefs or rocks, icebergs, or any other obstacles in their path. With a radar altimeter, an aviator can determine the height of his plane and can then fly above any mountains, treetops, tall structures, or other

Radar—An Electronic "Eye"

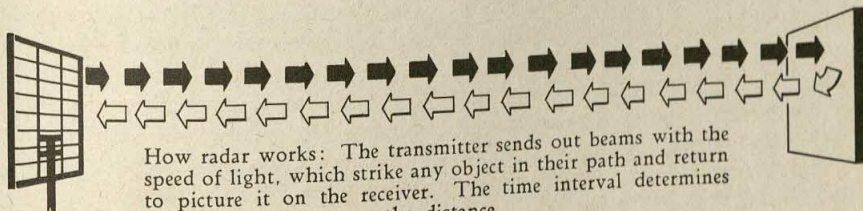
Electronic waves from a transmitter strike the target and bounce back to the radar receiver, just the way a rubber ball, thrown against a wall, bounces back to the boy who tossed it.



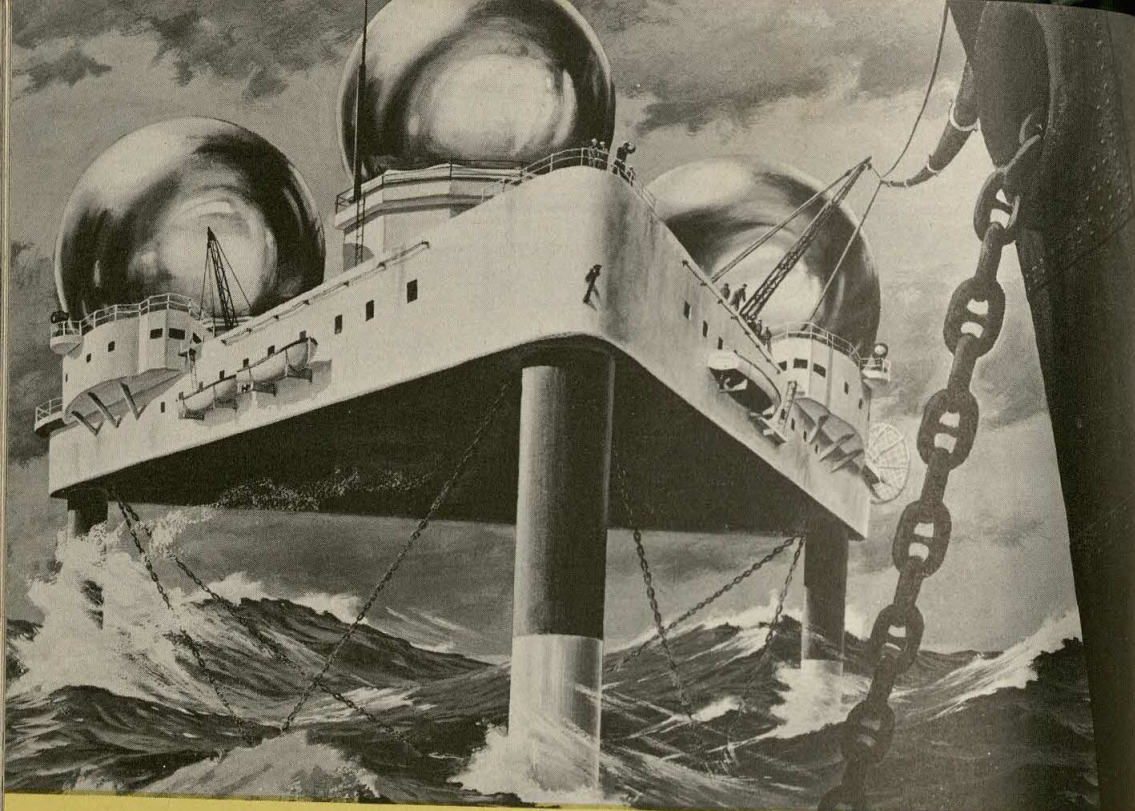
Radar can see through fog and cloud, enabling planes to locate an airfield or to avoid crashing into each other or into a mountain.



It can guide a ship through dangerous waters and into harbors; it can prevent a collision with an iceberg or another ship.



How radar works: The transmitter sends out beams with the speed of light, which strike any object in their path and return to picture it on the receiver. The time interval determines the distance.



International Nickel Company

THREE-EYED "MONSTER" FOR DEFENSE

The huge globes (above) house the electronic eyes of radar equipment. Such installations, called Texas Towers, are located in the ocean to guard America against sneak air attacks. Each man-made island stands on three stilts rising 81 feet above the water.

SEEING BY LISTENING

All-weather radar "eye" (below) can spot a single moving object a half mile away in darkness or fog, and vehicles or large groups much farther away. It does not use a radarscope but produces distinctive radio signals that are heard in the headset.

Sperry Gyroscope Company



RADIO

obstructions along his course. Radar is also used in helping planes to take off and land safely when visibility is poor, in locating distressed ships at sea, and in directing trains entering or leaving railway yards.

Radar is useful in locating approaching storms so that their coming can be forecast. With it, scientists have learned more about the flight of birds. It is also employed in transmitting sound, facsimiles, and photographs. See also **ELECTRONICS**; **RADIO**; **VACUUM TUBES**; **WAVES**.

RADIO. By a simple twist of a dial, civilized man today brings the world into his home. At a touch of his finger come greetings from a daring explorer in the trackless wastes of the Antarctic; a second touch, and he hears the dramatic and urgent appeal for help from a flood-stricken city; a third twist and the beautiful strains of a Beethoven symphony fill the room.

This is radio—one of the modern world's most used, valued, and powerful forces in the realm of communications.

Radio in Our Lives. The effect of radio on civilization has been tremendous. The ability of the radio to reach millions of persons at once, especially by the national and international "hook-ups," has been a great unifying force, both for good and evil. It enables the businessman to sell his goods in greater quantities; it can bring music and the words of outstanding men into the home, thus becoming a carrier of culture and education, as well as a medium for spreading propaganda. Ships and airplanes now furnish better and safer transportation because radio keeps them in touch with land. Radio direction finders, radio beacons, radio beams, radio-range stations, and ship-to-shore radio telephone are typical of the radio devices that have meant so much to the progress and safety of aviation and navigation. Radio has been of incalculable value to police departments in the work of reducing crime and apprehending criminals. Radio-equipped cars, many carrying both receiving and transmitting equipment, enable squads to arrive at the scene



RADAR SCANS THE SKIES *Westinghouse*
At lonely outposts, the radar antenna is a sentry, guarding against surprise air attack.

of a crime on short notice.

Radio facsimile has permitted the reproduction of photographs in newspapers a few hours after they are taken thousands of miles away.

How Radio Works. What is this thing called radio? How can it perform its wonders?

Radio waves are electromagnetic radiations like visible light waves, but of slower frequency and greater wave length. They travel through space with the speed of light, or about 186,300 miles per second. Let us imagine that the ether, which is supposed to fill all space, is a pond of smooth water on which some twigs are floating. If we drop a stone into the pond, a series of ripples or waves emanate from the point where the rock struck the water. These spread out in ever-widening concentric circles, and the twigs bob up and down as the waves strike them. The stone, in the case of radio, is the transmitting station which, through an electric circuit carrying a radio-frequency current, sets waves of ether in motion. The twigs are the receiving sets which intercept the waves and are affected by them.

With this in mind, let us see what happens to a sound from the time it is created until we hear it through the loud speaker. The time it takes, of course, is but a tiny fraction of a second, but it goes through many changes in its swift travel. First of all, the sound vibrations or waves reach the microphone. Sometimes these waves or vibrations are very rapid and sometimes slow, varying from 50 to 10,000 per second, or more. Usually, if the vibrations are above 10,000 per second, the human ear cannot catch their sound.

The microphone, which may be of a *carbon, condenser, dynamic, ribbon, or*

crystal type, receives these vibrations and then changes them into vibrations, or cycles, of electric current. The current is then led by wires to the control room where are located *mixers, amplifiers, equalizers, and volume and tone controls*. From here, the current is sent by leased telephone wires to the transmitting station, which is usually located out of town to lessen interference.

The current reaching the transmitting station oscillates in a range of 40 to 10,000 times a second. This is within the *audio-frequency* range, which varies according to the quality of the equipment. However, the current cannot radiate from

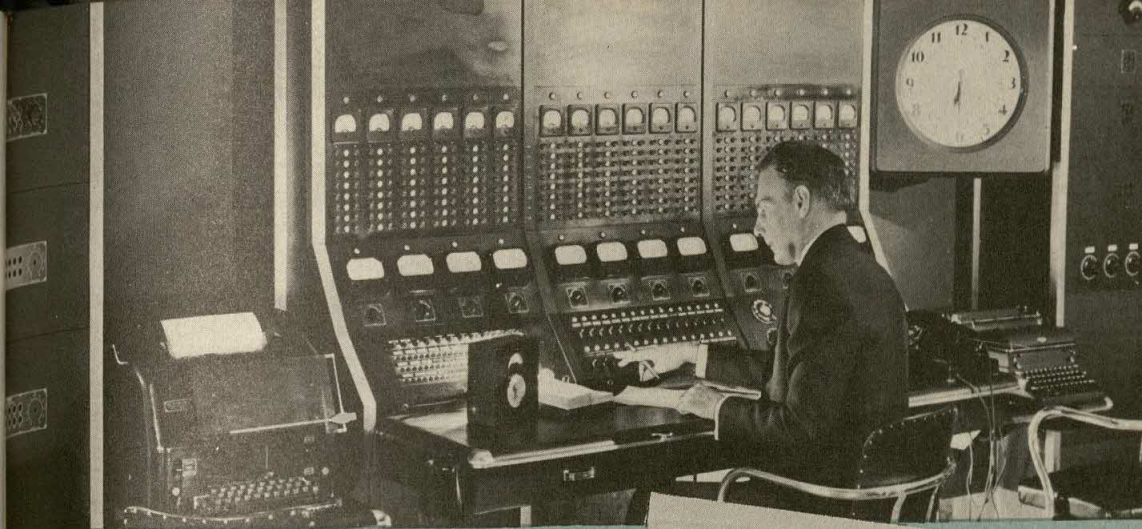
THE BIG AND THE SMALL BROADCASTING

At left, newsmen report a national election. Below, a four-hundred-man orchestra performs.



CBS Radio; NBC Photo





RADIO MOVES OUT OF THE STUDIO

Above, the master control panel — hub of communications. Right, a radio-equipped police car. Below, a mobile unit, broadcasting on the move. Bottom, broadcasting from the classroom.



Station WLW: CBS Radio; Westinghouse University of Illinois Photo



the antenna for any appreciable distance. So the transmitting station generates *radio frequency*, in which the vibrations or cycles range between 10,000 and 400,000,000 (or more in some cases) per second. The number is usually expressed in thousands (kilocycles). Thus, 500,000 cycles per second is expressed as 500 kilocycles.

Here, in the transmitting station, radio frequency is generated by vacuum tubes. Most of these contain a *plate*, a *filament*, and a *grid*. The filament, when heated, emits electrons, which are negatively charged. These are attracted to the positively-charged plate and they flow to it, then through the plate circuit and back through the power supply, creating a direct current. A small amount of power in the grid circuit controls a relatively large amount of power in the plate circuit, a factor that makes the tube capable of amplifying. This amplifying power is one of the main reasons why a vacuum tube can generate radio-frequency energy. Another main reason is the oscillation of a "tank circuit" (a coil shunted by a condenser) caused by an electric shock. The circuit is between the plate and the power.

The grid circuit, which has variations in voltage, causes radio-frequency variations in the plate current, and radio-frequency current will flow in the tank circuit. The grid and plate circuits are coupled in such a way that a small part of the radio-frequency energy in the plate circuit is fed back to the grid, and this feedback causes the variations in grid voltage. The frequency of oscillation is controlled by carefully ground quartz crystals employed in special circuits. This is important in broadcasting, where stability is necessary.

The oscillation of the circuit produces the radio-frequency current that is fed to the antenna from which the waves radiate into the air. These are called *continuous waves*, and in the case of radio telephony, the continuous wave is a *carrier*. But, before being radiated, the carrier undergoes modulation and amplification. Modulation varies the intensity of radio-frequency

vibrations in accordance with audio-frequency vibrations. When the current has been generated, it is amplified in a series of stages, each stage using one or two vacuum tubes, and is sent into the antenna.

The electromagnetic waves radiating from the transmitting aerial, known as *Hertzian waves*, were compared in a preceding paragraph to the concentric circles of water in a pool disturbed by a stone. The wave length of the radio waves may be thought of as the distance between two crests of concentric water waves. This distance is measured in meters, and each broadcasting station sends out waves of a certain length. Thus, one station may have a wave length of 600 meters, while another may operate on a 590-meter wave length. The wave length is determined by the frequency of oscillation of the transmitted wave. If the oscillations are between 10 and 100 kilocycles per second (low frequency), the waves are very long; if 100 to 1,500 kilocycles (medium frequency), they are of medium length; if 1,500 to 6,000 kilocycles (medium high frequency), they are fairly short; if 6,000 to 30,000 (high frequency), they are short; and, if they are above 30,000 kilocycles (ultra-high frequency), the waves are very, very short.

Now, how does the sound come out of the loud speaker? The receiving set, to a certain extent, reverses the process of the transmitter. The principal difference between a receiver and transmitter is that the receiver has a detector, which is usually a vacuum tube, but which also may be a crystal. To receive the waves from a transmitting station, the receiving set is placed "in tune" with those waves. Tuning is usually accomplished in radio-frequency amplifier and detector stages.

A detector tube and its circuits act as a valve, separating the modulation from the carrier wave and eliminating the carrier. The modulation is passed along to the amplifying system, and then through headphones or a loud speaker.

Radio's Growth. Radio can trace its beginnings to 1865, when James Clerk



SOME ALL-TIME FAVORITES OF RADIOLAND

CBS Radio

Left to right, cowboy star Gene Autry, comedians Amos 'n' Andy, and singer Bing Crosby.

Maxwell, of Scotland, outlined and predicted the action of ethereal waves. Then, about 1888, Heinrich Hertz, a German, succeeded in generating electromagnetic waves, or radio impulses. Later, Sir Oliver Lodge and other scientists experimented with the Hertzian waves as a medium of communication.

These investigations led to the experiments by Guglielmo Marconi, who, in 1894, made a set of instruments that could send and receive messages. Two years later he sent a radio message two miles, and in 1897 he flashed a message from ship to shore. The first international radio communication was accomplished in 1899, when a message was sent across the English Channel, and two years later one was sent from England to Newfoundland.

Improvements came rapidly, and in 1904 Sir John Fleming of England invented the Fleming valve and applied it to the detection of these waves. Two years later, Dr. Lee De Forest improved the Fleming valve by adding the grid, and the vacuum tube as we know it came into being. This presaged the elimination of spark and arc methods of generating radio frequency, and the crystal as a detector. World War I brought further improvements, and since then radio has made giant strides.

For receiving sets, the superheterodyne circuit, multigrid tubes, and automatic volume control came into being; directional antennae, single dialing, high-frequency transmission, and automobile radio sets are other developments which have characterized the growth of radio.

Outstanding among newer developments in radio mechanics is the static-free system of broadcasting known as *frequency modulation* (F-M). It is the invention of Major Edwin H. Armstrong. Unlike standardized radio, in which a fixed frequency is maintained, the F-M system operates on the basis of variable frequency and fixed volume or power. Since static consists of power variations, standard receiving sets pick up interference of various kinds. F-M receivers disregard interference, and the F-M system is practically static-free. Other important developments were radio photography, telegraphy, and telephony. Today, the radiotelephone is used in transoceanic, international communication and by mobile ships, trains, aircraft, taxicabs, and police and fire-department cars. The "walkie-talkie" is a radio telephone.

About half of the world's radios are in the United States, where some 98 per cent of all homes own one or more sets.

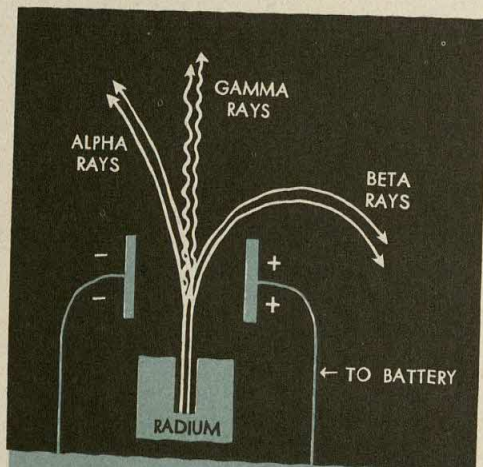
Portable sets are commonplace, and radios are used in business houses and automobiles, even on trains, buses, and farm tractors. The rapidly growing television industry became a serious competitor to radio after World War II.

For further information, see the following:

Electricity
Electronics

Light
Television

Vacuum Tubes
Waves



RAYs FROM RADIIUM

Alpha rays bend toward a negative plate and beta rays toward a positive one. Similar deflections would occur in a magnetic field perpendicular to the page and directed toward it. Electric and magnetic fields do not deflect gamma rays.

RADIOACTIVITY, *ra di o ak tiv'i ti*.

Most of us know how radium, the amazing substance discovered by Madame Curie and her husband, in 1898, unceasingly gives off invisible rays that have the power to pierce solid substances, to ionize gases, to affect photographic plates, and to do other remarkable things. Because these rays are not merely reflected rays of heat or light, but come from the substance itself, radium is said to be *radioactive*, or to have the power of *radioactivity*.

Radium is but one of many radioactive substances. Uranium, thorium, polonium, and other elements discovered since radium, are also known to be radioactive.

A gram of radium will give off in a year's time enough heat to raise the temperature of more than 1,000,000 grams of water 1°C. (see CALORIE). And in spite of this immense outpouring of energy, after seventeen centuries the same gram would still be able to give off more than 500,000 calories in a year.

We know that both radium and uranium give off three kinds of rays and that all other radioactive substances give off one or more of the same three. The three kinds are named *alpha*, *beta*, and *gamma* rays, after the first three letters of the Greek alphabet. The alpha rays are particles of helium gas charged with positive electricity. They have a maximum rate of about 12,000 miles a second. A gram of radium expels 145,000 billion particles in a second. The beta rays are electrons, moving with nearly the speed of light. The gamma rays are electromagnetic waves of extremely short wave length, moving with the speed of light, nearly 186,300 miles per second.

The gamma rays are not affected by the electric and magnetic forces which can make alpha and beta rays follow a curved path. The alpha rays, when they are present, make up the greater part of the discharge, but their penetrating power is almost negligible; a heavy sheet of paper stops them. Beta rays have much greater power in that respect, as the hardest rays penetrate as much as two millimeters of lead. Gamma rays can penetrate several inches of lead, and are more powerful than X-rays. Alpha rays have the greater power of ionization.

Scientists long believed that it was impossible to change one element into another. But the study of radioactivity since its discovery by the French scientist Henri Becquerel in 1896 has upset this belief. In 1919 the British physicist Sir Ernest Rutherford transformed nitrogen into oxygen, and we now know that radioactivity is the direct result of the breaking up of atoms, once considered indivisible.

Later, the French scientists Frédéric Joliot and his wife, Irene, daughter of

Pierre and Marie Curie, proved that radioactivity could be produced artificially. Since they first produced it, in 1933, in normally nonradioactive aluminum and boron, radioactive forms have been made for nearly all the elements, greatly increasing the world's supply of radioactive substances.

Both artificially and naturally radioactive substances are widely used in treating cancer and other diseases, and as "tracers" in studying life processes in animals and plants. When injected into the human body, for example, they emit rays that enable doctors to study the functioning of its organs and the effect of foods and drugs upon them. Exposure to too many radioactive rays can, however, be injurious and even cause death, as was so tragically proved when radioactive atomic bombs were dropped on Japan during World War II. See CHEMISTRY; RADIUM; URANIUM; WAVES.

RA'DIUM. The discovery of this chemical element by Marie and Pierre Curie in 1898 was a truly great one. Although they first found radium chloride, a radium salt, Madame Curie isolated the element in 1910. Because it is so difficult to obtain pure radium, radium chloride and bromide are the forms generally used.

Radium comes from uranium, which is found chiefly in pitchblende. For information about sources of this mineral and about radium's place in the series of elements produced by the disintegration of uranium, see URANIUM.

A silver-white element, radium is radioactive—constantly giving off heat-energy and three types of invisible rays (see RADIOACTIVITY). Like uranium, it is also constantly disintegrating, or changing into other elements. Fortunately, however, additional supplies are constantly being produced by uranium.

The disintegration of radium occurs spontaneously and at a fixed rate. Nothing anyone can do will start, hasten, retard, or stop it. It should be understood, however, that most of the *mass* of the element

remains, although this remainder is no longer radium. The resulting elements are, in the order of their formation, radon; radium A, B, C¹, D, E, and F; and uranium-lead. Except for the last, all of these are radioactive, but no two remain so for the same length of time. The half-life of radium—the period during which half of its radioactivity is lost—is about 1,590 years. That of radium C¹ is about one ten-thousandth of a second.

Obtaining radium is difficult and costly, for a ton of pure uranium might contain no more than 300 milligrams of the element. As late as 1937 less than two pounds had ever been produced, but the use of uranium to produce atomic power has since increased the supply of radium and cut its cost.

Too-long exposure to radium can cause severe burns, even death. Yet it is also very beneficial, for its emanations, especially its gamma rays, can destroy unhealthy tissue. It is, therefore, widely used in treating cancer and other growths, some infections, and other ailments. Its gamma rays also are used in examining steel welds and castings. Radium paints are used in illuminating watch and clock dials, house numbers, and other articles, but carelessness in applying them has resulted in burns, poisonings, and deaths. Because it is so dangerous, radium for sale is sealed in specially made glass or metal tubes. See CHEMISTRY; CURIE, PIERRE AND MARIE.

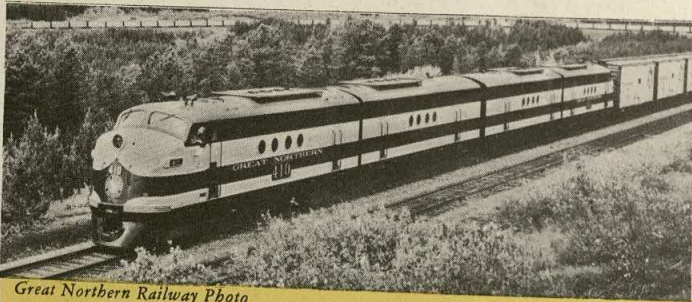
RAG'WEED. Of all the plants that cause hay fever, the ragweeds are among the worst offenders. They are a family of coarse, shrubby annual and perennial plants of the Composite group. It infests pastures, cultivated fields, and waste areas not only in the United States and Canada but also over much of Europe as well. Annual ragweeds may be controlled by mowing them before they set pollen and again in late summer, perennials by digging out their rootstocks or by treating them with herbicides. The leaves appear tattered, or ragged, and this gives the plant its name. The flowers of the rag-

weeds are small and yellowish or greenish in color. Both the *common* and *giant* ragweeds are prolific nuisances in the grain fields. Many persons are affected by the ragweed pollen, which is carried by the wind.

RAIL, rale. The several species of rails are all marsh birds closely related to gallinules and coots. They usually live in grassy marshes, feeding on water animals, seeds, and the tender parts of plants. Only as a last resort do they take flight. When they do fly it is in a labored fashion with legs dangling, and after a few rods they

tire and then drop back into the marsh.

Rails are grayish or reddish brown, more or less streaked, with thin bodies, long, strong legs and toes, and short wings and tails. One group has long bills, and includes the *king rail*, or *fresh-water marsh hen*, about eighteen inches long; the *clapper rail*, or *salt-water marsh hen*, about fourteen inches long; and the smaller *Virginia* rail. The short-billed rails are birds five to ten inches in length and include the *sora*, or *Carolina rail*, best known of all the group, the *yellow rail*, and the *little black* rail.



Great Northern Railway Photo

The Railway Network that Unites a Nation

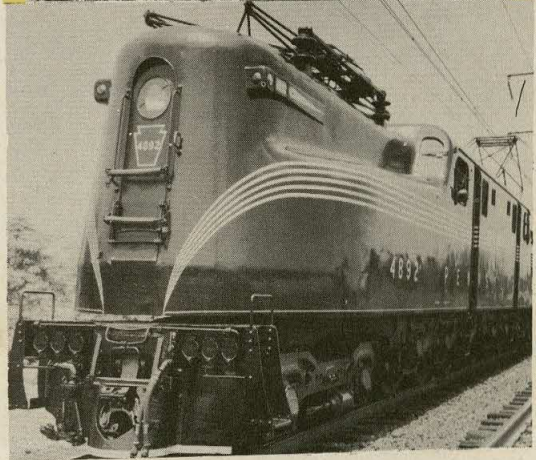
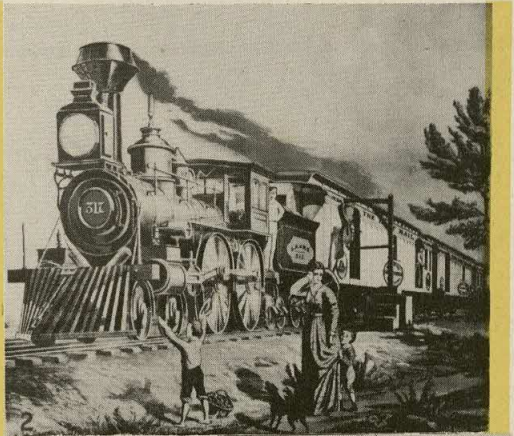
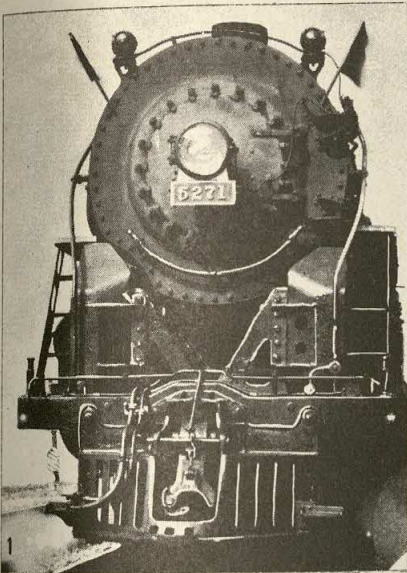
RAILROAD, or RAILWAY. Despite the advent of the airplane, the truck, the bus, and the pleasure automobile, the railroad is still man's greatest carrier of goods and, except for the pleasure automobile, of people. The history of the United States, where railroads have had their greatest development, is closely bound up with the story of locomotives, cars, and ambitious pioneering of nineteenth-century capitalists who spread a network of track over the nation. The railroad was an important factor in welding the American people into one nation, for it helped to break down sectional barriers. It was equally important in building up national unity in Canada.

Today, the railroad still exerts a tremendous influence on the life and affairs of the many nations served by an extensive

network of steel rails. Every day in the United States, passenger coaches carry thousands of travelers in comfort. Many suburban dwellers use them to and from their city work. Long-distance travelers may eat their meals in a diner and sleep in a reclining seat, berth, drawing room, compartment, or roomette.

Every day, other types of cars carry all sorts of goods to and from cities, farms, mines, mills, factories, and stores. Many manufacturers depend solely upon trains to bring in their raw materials and to distribute their finished products. Gondolas and hopper cars transport coal, ores, stone, and gravel from mines and quarries. Open flatcars carry huge machines; closed boxcars, countless types of goods. Oil, milk, chemicals, and other liquids travel by tank car, and refrigerator cars





FAMOUS "IRON HORSES"

(1) This is the type of locomotive which brought the Twentieth Century Limited through on time for many years; it pulled one of the most popular extra-fare trains running between New York and Chicago. (2) This is the "Fast Mail" of the Lake Shore and Michigan Southern Railway, which about 1875 was advertised as the "popular passenger route between the East and West"; it became part of the New York Central System. (3) One of the Pennsylvania Railroad's powerful electric locomotives, the first to be streamlined.

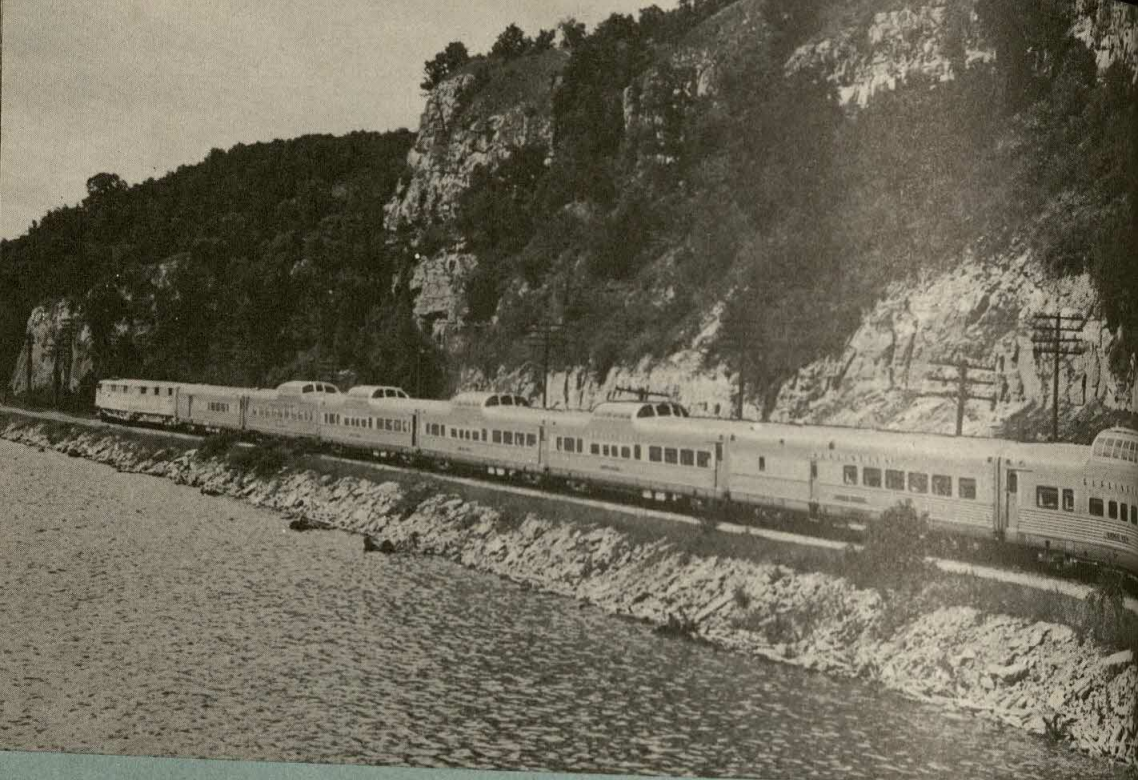
rush perishable fruits, vegetables, and meats to market. Many trains even pull mail cars that are traveling post offices, in which letters and parcels are sorted as they speed toward their destination. In wartime, railroads are busy carriers of troops, as well as tanks, guns, and other materiel.

Billions of dollars are invested in the large, complicated business of railroading, which spends billions annually on upkeep and operation and employs millions of workers. The progress of every train is watched from the start to the end of its trip. Automatic block signals, air brakes, and many other devices are used to guard it against accidents.

Yet railroading as we know it is only a little more than a century old. As early

as the 1600's, horse-drawn cars carried coal over short, wooden-railed tracks in England. An improved version of these roads was opened in 1826 to carry granite from a quarry at Quincy, Mass., for building Bunker Hill Monument at Charlestown (now in Boston). This is sometimes called the United States' first railroad.

The world's first line to use a steam locomotive was the Stockton & Darlington in England. Opened in 1825, and using an engine invented by George Stephenson, it began organized railroading. The first real steam locomotive ever run in America was the English-made *Stourbridge Lion*. Had it not proved to be a failure when it made its maiden trip over the Delaware & Hudson Canal Company's wooden track near Honesdale, Penn., in 1829, it would have



C. B. & Q. R. R. Co.

SPEED, COMFORT, AND A WONDERFUL VIEW

Glass domes permit the modern train-traveler to admire the scenic wonders along his route.

become a coal-hauler. But the honor of starting the first American railroad for passengers and freight goes to the Baltimore & Ohio, which began construction in 1828. In the following fall, Peter Cooper ran his model *Tom Thumb* over the company's thirteen-mile track and sounded the death knell for its horse-drawn and sail-powered cars. The first regular steam-service was, however, started on Christmas, 1830, by the South Carolina Railroad. The completion of the first transcontinental railroad in 1869 was another history-making event.

Today, the United States has some 227,000 miles of railroad, more than any other country in the world. Its nearest competitors are Soviet Russia and Canada.

In the United States, railroads now face stiff competition. Buses, for example, can offer lower passenger fares; trucks can travel much faster. To meet this challenge, many railways have speeded up and improved their service, with Diesel streamliners, air conditioning, and "vista-domes."

For additional information, consult the following articles:

Air Brake	Interstate Commerce
Cape-to-Cairo Railway	Act
Common Carrier	Locomotive
Diesel Engine	Public Utilities
Electric Railway	Semaphore
Transportation	

RAIN. Without moisture life is impossible, and the great source of moisture on the earth's surface is rainfall. Where there is none, neither plants nor animals can live except by means of irrigation, or by transporting water and food from a distance. Even underground rivers and streams are replenished by rain.

Rain occurs as one step in a cycle of natural processes. The cycle begins with evaporation into the air of water from rivers, lakes, and the sea. Air always contains some water vapor; but when it is warm, it can hold more than at other times. There is a limit, however, to the amount of moisture the atmosphere can carry at any given temperature. When that point is reached, the atmosphere is said to be

saturated. Warm air always rises, and as it does, it becomes cooler and can carry less moisture. At a certain point the water vapor condenses. Raindrops are formed when condensation proceeds actively beyond the point where a cloud first forms. When the drops grow to a size large enough to fall, there is rain. Wind often causes rain. If a current of warm saturated air moves quickly toward a cooler region, the moisture condenses and forms clouds. As it gets cooler, this moisture begins to fall in the form of rain.

Rainfall is measured in terms of inches. It is caught for this purpose in a specially designed container equipped with a gauge. Official records are kept by stations of the United States Weather Bureau. If a rainfall of one inch is announced, this means that a total of 113¼ short tons of water has fallen on an acre of ground. Variations in the amount of rainfall in different areas depend on geographical conditions and on the prevailing winds. In regions where prevailing winds from the sea blow against mountains, there is apt to be considerable rainfall, for, as the moisture-laden air rises above the mountains, it becomes cooled and the moisture condenses and falls in the form of rain or snow. Regions on the leeward side of the mountains are dry, as in Eastern Oregon. Desert regions occur where there are no large bodies of water to supply moisture by evaporation, or where the prevailing winds are so hot and dry that the air can absorb much moisture before reaching the saturation point.

Parts of India have the greatest rainfall during the year, more than 400 inches. The rainfall at the equator is about ninety-five inches a year.

For additional information, consult the following articles:

Arid Region	Hail
Cloud	Humidity
Desert	Irrigation
Dew	Meteorology
Dust, Atmospheric	Physical Geography
Evaporation	Rainbow
Flood	Snow
Fog	Storms

RAIN'BOW. Arching across the sky during a shower, the rainbow with its softly beautiful colors is formed when the sun shines on falling drops of water. These drops of water function as prisms. The colors are caused by the unequal refraction, or bending, of the different colored rays of which white light is composed, and by the internal reflection of light rays as they pass through the raindrops. The order of colors in a pure rainbow, beginning on the outside, is: red, orange, yellow, green, blue, indigo, and violet.

The rainbow appears as an arc because each color is formed by light rays which reach the eye at a given angle, and this angle never changes for the same color. A second and fainter rainbow, in which the order of colors is reversed, is sometimes seen, and is caused by double refraction and double reflection. A rainbow is not visible if the sun is high in the sky, and for this reason most bows are seen in the early morning or late afternoon. Rainbows always appear in the opposite direction from which the sun is shining. See **COLOR**; **LIGHT**.

RAINIER, *ra neer'*, MOUNT. Snow-capped Mount Rainier, in the state of Washington, rears its lofty peak 14,408 feet above sea level. It is in Mount Rainier National Park. On its southern side sprawls Nisqually Glacier, a portion of a great glacier system. The mountain, an extinct volcano, is about fifty miles southeast of Seattle. Paradise Valley, at an elevation of 5,557 feet, is the base for the mountain climb and has hotel and camp facilities. See **PARKS**, **NATIONAL**.

RAISINS, *ra'z'ns*. Every year thousands of tons of California raisin grapes are changed into delicious, health-giving raisins. The process is relatively simple. Preferably, the vines are partly cut and the grapes are permitted to dry and shrivel naturally from the sun's heat. A quicker method is to place the grapes in trays, dip them into a lye of wood ashes and quicklime, and then permit the sun to dry them.

Those produced by the natural method

are called *sun raisins* or *muscatels*, those by the chemical method are termed *lexias*. After a thorough drying, raisins are placed into bins known as *sweat boxes*, from which they are withdrawn for sorting, weighing, and packing. The cheaper grades of raisins are oven-dried.

Practically all raisins consumed in the United States are produced in California, although other important sources are Spain, Italy, Greece, Asia Minor, and Egypt. Popular varieties of raisins include the Thompson seedless, the seed-bearing muscat, and the small, seedless, yellow sultana. See GRAPE.

RALEIGH, *raw'li*, N.C. Lying in the heart of one of the South's richest farming areas, Raleigh is an important market and educational center and the capital of North Carolina. Its manufactures include woolen worsteds, rayon, nylon, and cotton goods, processed fruits, concrete products, and fabricated steel.

The city is beautifully located along the "Fall Line" that divides the Piedmont from the Atlantic Coastal Plain. The handsome, granite Capitol was completed in 1840. Other outstanding buildings include the governor's mansion, the city auditorium, the supreme court, Federal, and insurance-company buildings, and those of the North Carolina State College of Agriculture, Engineering, Textiles, and Design. Other educational institutions include Meredith, Peace, and St. Mary's Colleges for women, and Shaw University and St. Augustine's College, both for Negroes.

The site of Raleigh was chosen for a state capital in 1788, and the city was laid out in 1792. It was named in honor of Sir Walter Raleigh. It has a population of about 95,000.

RALEIGH, **WALTER**, Sir (about 1552-1618). The fame of Sir Walter Raleigh need not rest on the persistent legend that he once threw his cloak across a mud puddle to allow Queen Elizabeth I to cross a street. As a brave soldier, an adventurous navigator and buccaneer, the writer of a history of the world, and a statesman

whose policies affected England profoundly in the sixteenth and seventeenth centuries, he holds a notable place in history.

Educated at Oxford, Raleigh first attracted notice as a soldier in the Huguenot wars in France when he was seventeen. Later, with his half-brother, Sir Humphrey Gilbert, he became a buccaneer against Spain in the West Indies, and then served a year as infantry captain in Ireland, where he put down an insurrection. Because of his gallantry and wise advice Raleigh had great influence at the court of Queen Elizabeth, and received many favors at her hand.

He became a member of Parliament, and was given a charter to colonize America. Although his several attempts to found settlements in Virginia and North Carolina were failures, they resulted in the introduction of potatoes and tobacco into England. In 1595 he embarked for South America to find the fabled El Dorado. He did little except take possession of some territory on the Orinoco River, but in 1596 he participated in the capture of Cadiz.

Queen Elizabeth died in 1603, and Raleigh was disliked by King James. He was accused of plotting to overthrow the monarch and was sentenced to death. He was reprieved, but was imprisoned in the Tower of London for twelve years. During that time he wrote his *History of the World*, as well as a number of essays on philosophical and religious topics. On his offer to mine gold on the Orinoco, Raleigh was released in 1616. An expedition set out in 1617, but proved unsuccessful. He had been forbidden to touch any Spanish property. Nevertheless, his party had taken possession of the town of San Tomás, and on his return to England, Raleigh was executed, the original sentence being carried out.

RAMAYANA, *rah mah'yah nah*. A great epic poem of India is the *Ramayana*, a long, narrative work, probably written not later than 500 B.C. It deals principally with the victory of the demigod



YOUNG RALEIGH HEARS OF SEA ADVENTURE

This painting by Millais shows Sir Walter Raleigh as he must have listened as a boy to sailors' tales of strange lands.

Rama over the king of demons, who lived in Lanka (probably Ceylon).

RANDOLPH, JOHN (1773-1833). Probably the best-known member of the celebrated Randolph family of Virginia, "John Randolph of Roanoke" was for more than thirty years the most colorful and widely publicized statesman in the United States. "Roanoke" was his estate on the Staunton River. He used the term in connection with his name because he disliked a relative also named Randolph, and wished to be distinguished from him.

Randolph was educated at the College of New Jersey (now Princeton) and at Columbia, and later entered the practice of law. His wit and political sagacity won him a seat in Congress in 1799; immediately there began the long series of bitter conflicts and eccentric activities which characterize Randolph's career. He was Democratic majority leader in the House,

but opposed Jefferson on the War of 1812 and the Missouri Compromise. From 1825 to 1827, Randolph had a seat in the Senate. His ability was finally recognized in his appointment as minister to Russia. In his will, he freed his slaves and provided for them.

RANK. The degree of authority vested in military and naval officers is indicated by rank. The regular military and naval forces of the United States are headed by the President. His rank derives from Article II of the Constitution: "The President shall be Commander in Chief of the Army and Navy of the United States, and of the militia of the several states when called into the actual service of the United States; . . ."

The accompanying table shows the relative ranks of officers next after the Secretary of Defense and the Army, Navy, and Air Force secretaries. The Marine Corps

RANK OF UNITED STATES COMMISSIONED OFFICERS

ARMY, AIR FORCE, AND MARINE CORPS

Rank	Insignia
General of the Army	Five Stars
General	Four Stars
Lieutenant General	Three Stars
Major General	Two Stars
Brigadier General	One Star
Colonel	Silver Eagle
Lieutenant Colonel	Silver Maple Leaf
Major	Gold Maple Leaf
Captain	Two Silver Bars
First Lieutenant	One Silver Bar
Second Lieutenant	One Gold Bar

NAVY, COAST GUARD, AND
COAST AND GEODETIC SURVEY

Rank	Insignia
Fleet Admiral	Five Stars
Admiral	Four Stars
Vice Admiral	Three Stars
Rear Admiral (Upper Half)	Two Stars
Rear Admiral (Lower Half) and Commodore	One Star
Captain	Silver Eagle
Commander	Silver Maple Leaf
Lieutenant Commander	Gold Maple Leaf
Lieutenant	Two Silver Bars
Lieutenant (Junior Grade)	One Silver Bar
Ensign	One Gold Bar

serves under the Secretary of the Navy, as does the Coast Guard in wartime.

Warrant officers, specialists of various kinds, enjoy the same privileges as commissioned officers. An army warrant officer's rank is just below that of a second lieutenant; in the navy, his rank is just below that of an ensign. Noncommissioned officers in the army and in the branches of service having the same ranks include various degrees of corporal and sergeant, and of petty officer and mate in the navy.

Top rank in Britain's army is Field Marshal; in her navy, Admiral of the Fleet. The highest rank in the French army is Marshal of France. After World War II, various international organizations, including the United Nations and the North Atlantic Treaty Organization, gave the rank of Supreme Commander to the leader of their forces.

Brevet ranks are honorary ranks given to officers; they are higher than the ranks for which the officers are commissioned and for which they are paid. Flag officers are the naval officers entitled to display flags indicating their command rank—admirals, vice admirals, rear admirals, or any other officers while in command of a fleet or part of a fleet.

For additional information, consult the following articles:

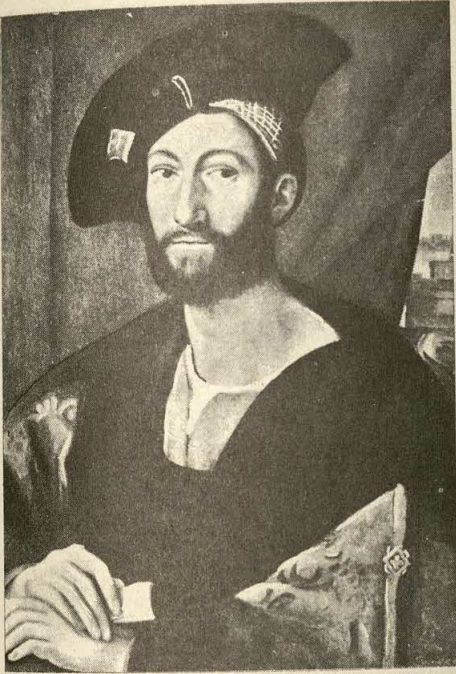
Army
Coast Guard

Marine Corps
Navy

RAPHAEL SANTI, *rah' fay el sahn'te* (1483-1520). This Italian artist lived during a great flowering of painting and sculpture, the period of the High Renaissance. Among the famous artists of that time he was one of the brightest figures, winning renown that has endured to this day. Raphael died of fever at the age of thirty-seven, but in his short life he accomplished wonders. He was a painter of large murals and of small, detailed pictures; he painted on canvas and on fresh plaster (the fresco method) with equal skill; his cartoons, or drawings used as models for pictures and tapestries, are themselves masterpieces of design. He was also a gifted sculptor and architect.

Personally, Raphael was handsome, lovable and generous. The sweetness and tranquillity of his nature are seen in his Madonnas, with which he is especially associated. His *Sistine Madonna*, a priceless treasure of the Dresden Gallery, is probably the best-known picture in the world.

Raphael was born in Urbino, the son of a talented painter, and he grew up in an artistic atmosphere. At the age of sixteen he became the pupil of Perugino, whose influence is seen in Raphael's earlier work. In 1504 he went to Florence, then a center of artistic greatness, and began developing an independent style. After four or five years, Raphael was invited to Rome by



WORKS OF A GREAT ITALIAN

The life of the artist Raphael was not long but it was full of accomplishment. Two of his famous paintings are shown here, that of Giuliano de' Medici and the *Madonna del Granduca*.

Bramante, the architect of Saint Peter's. There Pope Julius II became his patron, and at his command Raphael undertook the decoration of four rooms in the vatican. The frescoes with which he adorned the walls, including the *Disputa*, *School of Athens*, and *Saint Peter Freed from Prison*, are superb examples of the principles of composition.

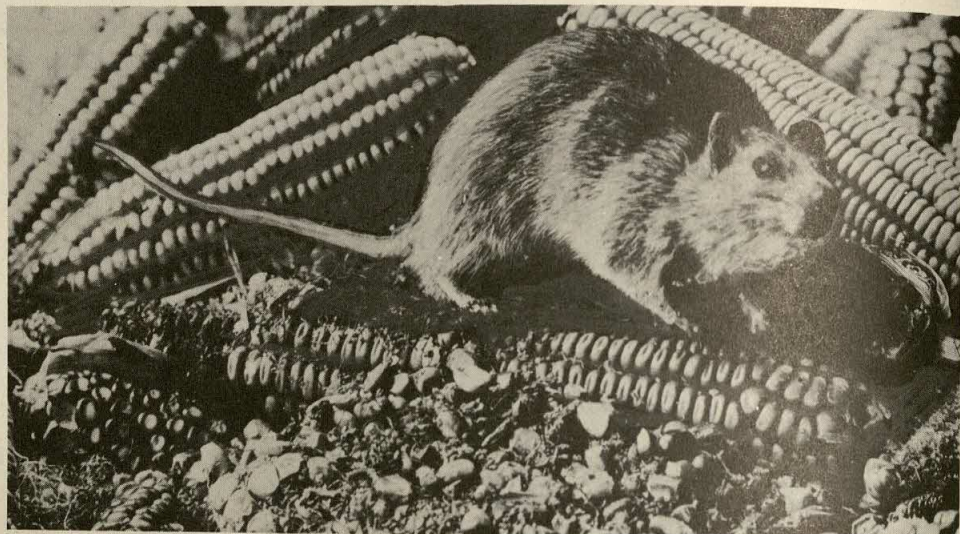
A list of the works of this industrious and always inspired artist reveals his remarkable versatility and intellectual pre-eminence. Among the pictures not mentioned above are: *Marriage of the Virgin* (Milan); *Saint Michael and the Dragon* (Louvre); *La Belle Jardinière* (Louvre); *Madonna della Sedia* (Madonna of the Chair, Pitti Palace); and *Transfiguration* (Vatican). The last, unfinished at his death, was carried at the head of his funeral procession. Raphael's tomb is in the historic building where so many great Italians are buried—the Pantheon in Rome.



RASPBERRY, *raz'ber i*. Wild or domesticated, the raspberry is an excellent example of how Nature protects her own. For this useful plant is armed with heavy, sharp thorns that considerably hamper the plucking of the fruit.

The raspberry plant, unless kept carefully pruned, will reach a height of seven or eight feet. It will bend over and a new sprout will spring up wherever a stem takes root. Unless controlled, the raspberry "patch" will soon become an impenetrable "jungle." The fruit is red, black, purple, or yellow, and, when ripe, can be pulled away easily from its cuplike receptacle.

The best-known species are the *red* and *black* raspberries. Both have considerable juice and may be compressed for the juice, or eaten raw, or made into jellies, jams, or pies. They are often canned for future use. Raspberries grow wild over great areas of North America, Europe, and Asia, but several species and varieties are cultivated in



International Harvester Co.

VILLAIN IN THE CORN CRIB

The rat is one of the farmer's worst enemies.

the United States and Canada. Because the fruit is soft and easily crushed, marketing is difficult.

RAT. Death and destruction follow the trail of the rat, a rodent found everywhere in the world. Every year, millions of dollars' worth of eggs, grains, fruits, vegetables, meats, and even small domestic animals such as rabbits and baby chicks are destroyed by this pest. In addition, rats spread germs with their feet and fur, and carry the fleas that cause the dread bubonic plague.

Originating in Central Asia, two species, the *brown*, or *Norway*, rat, and the *black* rat have migrated to all lands. The brown rats, more powerful and prolific than the black, have spread throughout the United States. They are a grayish brown in color, with yellowish-white undersides. They seem capable of adapting themselves to almost any surroundings—sewers, garbage dumps, farm buildings, riverbanks, homes, wharves, and even the open fields. They will live on carrion and the dirtiest sort of garbage when no finer fare offers. Vicious fighters, they often kill and eat one another, and have been known to kill pigs and calves and even attack man.

White rats, extensively used for medical experiments in laboratories, bear none of the characteristics that make the brown rat

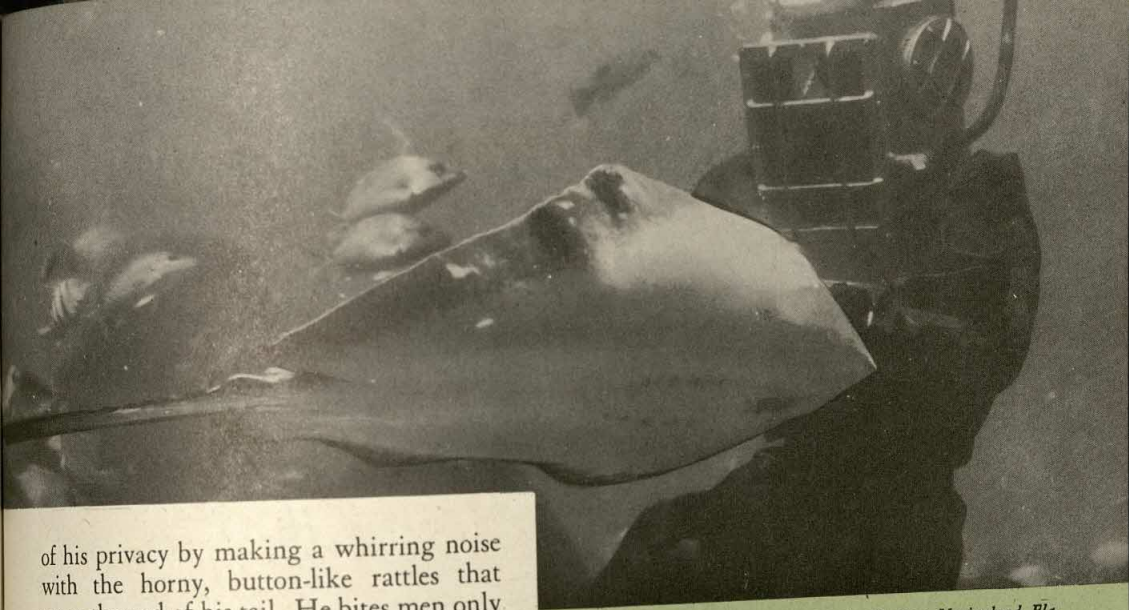
such a hated creature. They are perfectly harmless and may be kept as pets.

Dogs, cats, poisons, and traps are fairly effective as rat-killers, but the best means of control is the construction of ratproof buildings.

RATCH'ET. Often used on augers and screw drivers, the ratchet is a device which permits these tools to turn in one direction only. Movement in the opposite direction is prevented by the teeth of a ratchet wheel, similar to that of a typewriter carriage.

RATTAN'. The tough, flexible material that is made into wicker furniture, baskets, and canes was once the stem of a long, slender, climbing rattan palm. This plant often attains a length of several hundred feet, wending its way through the limbs and branches of trees in much the same manner as the wild grapevine. The palm is native to Africa, the East Indies, and Australia. The plants are gathered by natives, who split the stems into round or flat strips for export to America and Europe. The fruit and the young shoots are often used as native food. See **CANE**; **PALM**.

RAT'TLESNAKE. In spite of his reputation as a poisonous reptile, the rattlesnake always fights fair, warning any invader



Marine Studios, Marineland, Fla.

THE BAT OF THE OCEAN BOTTOM

A batlike sting ray swims close to a diver in one of the great tanks at the famous Marine Studios in Florida. The ray's weapon is its tail, which is equipped with dangerous spines.

of his privacy by making a whirring noise with the horny, button-like rattles that cover the end of his tail. He bites men only in self-defense, and if the horseman or hiker will only heed the rattler's warning and not molest him, there is small chance of being bitten. See **FIRST AID TO THE INJURED** for snake-bite remedy.

The number of buttons on the tail is said to determine the rattlesnake's age, but the snake will sometimes add more than one rattle a year, and frequently some buttons may be broken or worn off. Rattlesnakes give birth to their young alive, a litter consisting of twelve or more. Naturally retiring and shy, the rattler consumes his food, consisting of mice, rabbits, squirrels, rats, and birds, in darkness and solitude. Rattlesnake meat is edible, and has been canned. The skin of the snake is often used for shoes, belts, and purses.

Of the thirty-four known species of these American pit vipers, all but a few are found in the United States, especially in the dry Southwest. In fact, rattlers range from southern Canada to Uruguay. See **SNAKE**.

RA'VEN. Pictured by Poe in his famous poem as a doleful and melancholy bird, the raven actually is quite clever. A familiar fable tells of a raven dropping stones into a jar of water, raising the level until he could drink. Young ravens can be made into pets, and some of them even learn to talk.

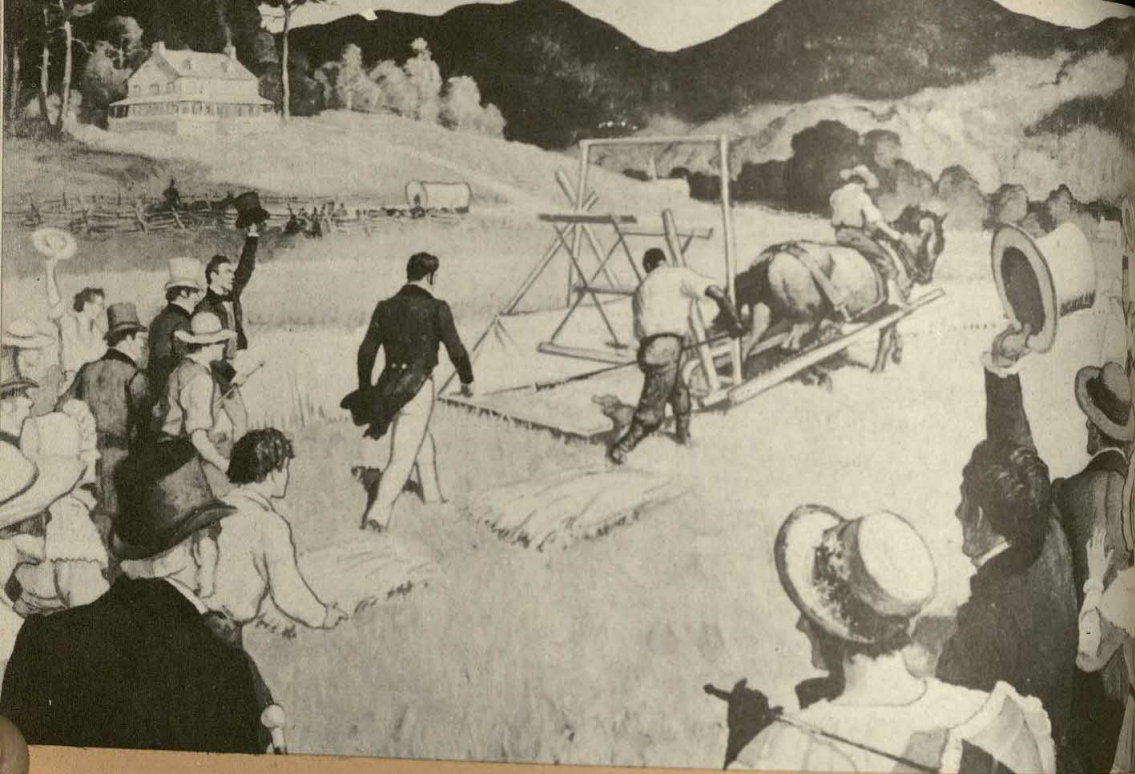
Largest member of the crow family, the raven usually grows to a length of about

two feet. It is coal black in color, and leads a solitary life. The raven will feed upon almost anything edible, but usually prefers the flesh of dead animals. In the spring it builds its nest on a high cliff and lays four or five speckled, greenish eggs. Ravens mate for life, living in the same nest year after year. They do not migrate. In the United States ravens are now found chiefly in the North and West.

RAY. Some of the fish known as rays sting or shock their prey to death. Some of them measure ten feet in length and are distinguished by their flat bodies and wing-like extensions on their sides. They are found in practically all seas. The group includes the sting ray, eagle ray, electric ray, devilfish, sawfish, and skate. See **SKATE**.

RAY'ON. See **SILK, SUBSTITUTE**.

RE, or RA, ray. Ancient Egyptian religion embraced the worship of many gods, chief among them Re, the sun god. According to legend, Re created order out of chaos and once saved mankind when he thwarted a rebellion. In sculpture and paintings he was represented as a man with a hawk's head crowned with a disc and



THE REAPER THAT REVOLUTIONIZED GRAIN FARMING
International Harvester Co.
 Here is shown the first public test of Cyrus McCormick's famous reaper, in 1831.

serpent. The principal temple dedicated to Re was at Heliopolis.

READING. There is a popular old saying that "we spend our first three years in school learning to read, then the remainder of our lives reading to learn." And it is true that when a child has once learned to read, he has the foundation of all knowledge. The type of reading he selects and the diligence with which he applies himself will undoubtedly have profound influence upon his entire life.

Reading is of two types—oral and silent. Training in both types is necessarily a part of early school life; in fact, too much attention cannot be given to training for efficient silent reading, since it is universally used throughout life, whether one reads for pleasure or instruction. The choice of reading matter is of utmost importance; and the school reading course should be planned to cultivate a taste for the finest literature, so that adults will have ability to make a wise selection of books in later life.

REAL ESTATE, or REAL PROPERTY. In speaking of real estate, people generally imply land and all that is on it and below it, such as trees, buildings, and minerals. According to law, it includes all property that cannot be removed without being destroyed. Real property belongs to the heirs of a person after his death. It cannot be legally sold except in a written contract. Because of its nature, real estate is easily taxed by the government. See **DEED**.

REAPING MACHINE. Of the many machines which have aided in making agriculture the world's greatest industry, the reaping machine, a device for harvesting small grains such as oats, wheat, rye, and barley, is one of the most important inventions which have brought machine-age methods and techniques to farming.

The first reapers were the crude stone or bone sickles used by the ancient Roman and Egyptian farmers. The next great advance in harvesting was the long-handled scythe, which was followed by the cradle,

a scythelike affair having several blades which permitted the farmer to cut more grain with each stroke. This method was used until the appearance of a mechanical reaper in 1826—Patrick Bell's scissor reaper. This machine cut the grain by means of a series of scissor blades which were placed in front of a moving canvas curtain which deposited the cut grain at the side of the machine. This machine was not widely used because of the opposition of the farm laborers. In 1831 Cyrus Hall McCormick perfected the first practical mechanical reaper.

McCormick's reaper was improved in 1858, and in that year the Marsh brothers of De Kalb, Ill., invented a hand-binding harvester, which revolutionized this phase of farming. Previous to this invention, all reapers had merely cut the grain and deposited it at the side of the machine, but the Marsh invention delivered the cut grain to a platform on the machine where men tied the grain into bundles. In 1871 a self-binding reaper, which tied the bundles of grain with wire, was invented by S. D. Locke, and in 1869 John F. Appleby invented the twine knotter, a mechanical device which would automatically tie the twine about the bundle. By 1882 the reaper essentially as we know it today was completed, but since then there have been many improvements in detail. See MCCORMICK, CYRUS HALL; OATS; WHEAT.

REBELLION OF 1837. Friction between the British Crown and the inhabitants of Upper and Lower Canada resulted in the rebellions of 1837 in these two provinces of Eastern Canada, now Ontario and Quebec. The uprisings arose from a desire to secure a more representative government or complete independence. Each province had a legislative council and governor appointed by the king and an assembly elected by the people, but with very limited powers.

Great discontent arose over the conduct of the government, and in Quebec a revolt was started under the leadership of Louis Joseph Papineau. A similar revolt in the

province of Upper Canada was led by William Lyon Mackenzie. Both rebellions were quickly put down, but one thing was accomplished, for the Earl of Durham was sent to Canada as Governor-General and High Commissioner. His report on the cause of the difficulties and his recommendations, submitted in 1839, led to the Act of Union in 1840, under which Upper and Lower Canada were again united as the Province of Canada. See CANADA, DOMINION OF.

RECALL', THE. Many of our state and city governments have adopted the recall to safeguard the interests of citizens against unworthy public officials. On the theory that what the people have done they should have the power to undo, the recall is declared to be justified. If a man is elected to any office in the gift of the people and he proves recreant to his trust, a small percentage of the voters within his jurisdiction may petition for a recall election, and on a designated day the voters decide his fate. The man whose office is in jeopardy is placed on the ballot, together with a duly nominated opponent. If the result of the ballot is unfavorable to the incumbent, he is automatically retired from his office, and his opponent succeeds to it.

In many states where the recall is in operation, judges are excluded from its provisions, on the theory that judicial positions should be kept out of politics as much as possible, and that no judge should be influenced in his decisions by waves of public opinion.

RECIPROCITY, *res i pros' i ti.* In government, reciprocity is a tariff agreement between two nations which is intended to facilitate exchange of goods by adjustment of import duties to mutual commercial advantage.

United States laws of 1897 and 1909 forced cancellation of several reciprocity treaties with foreign countries and, in 1911, Canada voted against a reciprocity plan approved by the United States government. In 1934, however, President Roosevelt was given the power to make favorable

"trade agreements" with other nations. A number of them were put into operation and had the effect of reciprocity treaties. See **TARIFF**.

RECLAMATION, *rek la ma' shun*. The turning of waste areas into useful land is called reclamation. Sometimes this is achieved by irrigating arid or semiarid sections. At other times, flood waters or swamps are drained off, erosion is stopped and prevented from recurring, or cutover forests are cleared of stumps and debris.

Some such projects are carried out by the individual owner of the wasteland involved, or by a group of private owners. Others are undertaken by companies in areas they own or lease. Often, however, the project is so extensive and costly, as well as so beneficial to the public generally, that it is planned, financed, carried out, and operated by a government—city, county, state, or national, or a combination of governments. An example of an international reclamation project is the series of irrigation-hydroelectric dams built by the United States and Mexico to reclaim vast, dry areas in the Rio Grande Valley. The draining of ocean-flooded areas in The Netherlands is the classic example of that special type of reclamation. Other huge and successful drainage projects have turned Italy's former Pontine marshes and parts of Florida's swampy Everglades into fertile farmlands. See **CONSERVATION**; **DAM**; **EROSION**; **EVERGLADES**; **FLOOD**; **IRRIGATION**; **LEVEE**; **RECLAMATION, BUREAU OF**.

RECLAMATION, BUREAU OF. Since nearly a third of the Western United States

receives less than twenty inches of rainfall yearly, a vast area of fertile, valuable land is wasted because it is too dry to grow crops. The first effort to begin remedying this situation was the passage by Congress of the Carey Act of 1894, which gave great sections of arid and semiarid land to the Western states to be reclaimed. The failure of the states to develop these areas on a satisfactory scale led to the passage of a Federal Reclamation Act in 1902. Under this law, Federal funds were set aside for planning and constructing irrigation works in the West. A Reclamation Service (later called the Bureau of Reclamation) was created in the Department of the Interior to administer the act. At first the law applied to arid and semiarid lands in Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Utah, Washington, and Wyoming, but Texas was added in 1906 and Alaska later.

Since then the Government has built many huge water-storage dams and irrigation systems in these areas and has made millions of acres of dry land capable of producing crops. Its primary object is to irrigate arid and semiarid lands so that they will become permanently productive farms. It also strives to maintain production on lands needing water to prevent their reversion to desert wastes. Minor goals include the generation of hydroelectric power, flood and silt control, the drainage of over-wet areas, improving navigation, regulating streams, providing municipal water supplies, and creating recreation facilities and wildlife refuges.

Although these reclamation projects have cost billions of dollars, impressively huge sums have already been repaid to the Bureau by the purchasers of reclaimed lands and by those who have bought water and electric power from it. Few farmers owning more than 160 acres are allowed to buy irrigation water from the projects. The cost to each is prorated according to the number of acres reclaimed, and each water user is allowed to repay his part of the

IRRIGATION MEANS LIFE TO LAND

the foreground, rocky, arid wasteland; in the background, fertile, irrigated farmland.

New Mexico State Tourist Bureau



expense in graduated sums over forty years. At the end of that period it is expected that three fourths of the Government's investment will have been repaid in cash, and that the benefits to the general public will be well worth the remaining fourth. See CONSERVATION; DAM; HOMESTEAD; IRRIGATION; RECLAMATION.

RECONSTRUCTION, *re kon struk'-shun*. After the War between the States, American history's pages were stained by the reconstruction era, a period of misrule, waste, vengeance, and excess in the government of the South, under the leadership of the radical faction of the Republican party in Congress.

Reconstruction, theoretically, was the process by which the seceded Southern states were to be readmitted to the Union, but the methods by which it was carried out served to alienate and embitter the Southerners. Had Abraham Lincoln lived, and been able to carry out his policies, the Southern states might have been readmitted without confusion and disorder.

Lincoln believed that it was within his power to pardon the seceded states and readmit them to good standing in the government as soon as they chose loyal officers. This theory, which presumably was held by the majority of Northerners, was opposed by Charles Sumner, Thaddeus Stevens, and other radical Republicans in Congress. This bloc held that the Southern states had deprived themselves of all civil rights by seceding, and that they were not entitled to equal status until certain reforms, dictated by the North, should be placed in effect. One reason for this policy was that they wished to make the Republican party dominant in the South through political control of the Negroes.

Lincoln put his policy into effect before the end of the war in Louisiana, Arkansas, Virginia, and Tennessee, but the Representatives of those states were not allowed to take their seats in Congress. Andrew Johnson attempted to carry out Lincoln's policies when he assumed office, but his unpopularity with Congress and tactless-

ness not only worked against the policies, but made it even more difficult to pursue a rational and moderate course in alleviating conditions resulting from the war.

On March 2, 1867, Congress passed the Reconstruction Act, which divided the South into five military districts. Unqualified men, including untrained Negroes, were permitted to hold state offices. Unscrupulous *carpetbaggers* from the North and *scalawags* in the South exploited the Southern states ruthlessly. The original aims of the Freedmen's Bureau were altered to benefit the politicians. The radicals manipulated the Negro's newly achieved vote ruthlessly, and terrorized the hard-pressed whites with Negro troops. Terrific tax assessments were levied against white property, and anarchy and crime reigned in certain areas.

Naturally, the Southerners, who were bankrupt and barely eking out an existence, resisted, and the result was the formation of the Ku Klux Klan. This organization gradually forced relief; and at the same time, people in the North, tired of the evils of reconstruction, urged reform. Grant became President in 1869, and by 1870 all the states were back in the Union. In 1871 occurred the repeal of the "ironclad oath," which disfranchised anyone who had fought for the Confederacy or had taken part in the government; and a year later a general amnesty was granted the South. Finally, in 1877, under President Hayes, the last Federal troops were withdrawn and reconstruction was over.

The effects of such injustice were far-reaching, however. The South was so embittered against the Republican party that it cemented itself into a solid, conservative Democratic area, which has remained practically intact. "White supremacy" became the by-word, with the result that many Negroes were deprived of the vote. It took many years for the South to recover from reconstruction, and many of the evils which arose from the period have not yet been corrected. See CARPETBAGGERS; CIVIL WAR IN AMERICA; KU KLUX KLAN.



THE RED CROSS COMES TO THE RESCUE IN TIME OF TROUBLE

American Red Cross

Disasters such as floods, fires, explosions, and storms send Red Cross emergency units into swift action. Above, a Red Cross worker aids a woman whose home has been destroyed by a tornado.

RED. Since it is one of the three *primary colors*, red cannot be made by mixing other colors. On the spectrum it is farthest away from violet because its rays are the least bent when a beam of light is refracted by a prism or other object. Thus it has the longest wave length of the seven *prismatic colors*. Red coloring matters, or pigments, include vermilion, carmine, red ochers, madders, and certain synthetic coal-tar products.

Long regarded as typifying blood, sacrifice, danger, and violent emotions, red is used symbolically in many flags and by many organizations. It is one of the national colors of the United States, Great Britain, and many other countries. Radical groups, aiming at the destruction of existing order, use red flags as their symbol and Soviet Russians consider red a joyous color. It is also used as a stop signal on traffic lights, and as a railway danger signal. An angry person is often said "to see red." See **COLOR**; **LIGHT**; **PRINTING**.

REDBIRD, the popular name of several birds, including the European bullfinch. See **CARDINAL BIRD**; **TANAGER**.

REDBUD, or **JUDAS TREE**. A gener-

ally smallish, ornamental tree with reddish-brown bark, the redbud is especially beautiful in spring, when its delicate rose-colored flowers bloom in masses before its heart-shaped leaves appear. It is sometimes called the *Judas tree* because Christ's betrayer is believed to have hanged himself on such a tree (see **JUDAS**). Its fruit resembles a string bean. One species, native to the eastern and southern United States, grows wild and is also planted in yards and parks.

RED CEDAR, a species of juniper that grows chiefly in North America. See **CEDAR**; **JUNIPER**.

RED CROSS SOCIETIES. In war-torn Italy in 1859, Jean Henri Dunant, a Swiss, saw so much suffering that he organized a band of volunteers to help him care for the wounded. Later he wrote of his experiences and urged the formation of societies to aid war victims. Still later he recommended also trying to relieve distress during epidemics and disasters, such as fires and floods.

The result was the formation of the International Committee of the Red Cross in 1864, of the League of Red Cross Societies in 1919 (both with headquarters at Geneva, Switz.), and of a national Red Cross Society in practically every civilized country. Among other things, the Committee acts

as a neutral intermediary between belligerents and aids the armed forces of both sides in wartime, while the League helps its members to give mutual aid during disasters. Although each national society has its own program, all work to prevent or to relieve suffering everywhere in times of both peace and war.

Most of the national societies use a red cross on a white field as their emblem, but those of most Moslem lands use a red crescent and Iran prefers its red lion and sun.

The American Red Cross was chartered by Congress in 1905, twenty-four years after Clara Barton had formed the first organization in the United States (see BARTON, CLARA). The society's affairs are administered by a Board of Governors, some of whose members are elected by its local chapters or by the Board. The rest are appointed by the nation's President, who serves as the society's president. The national headquarters are in Washington, D.C. The society is supported entirely by privately contributed funds, largely raised during its annual "membership drives." Both the senior society and the Junior Red Cross have millions of members.

During World Wars I and II and the Korean conflict, the Red Cross worked closely with the Federal Government in aiding members of the armed forces and their families, and in assisting civilians in war-shattered countries. Meantime, it carried on its regular peacetime program of relieving disaster victims at home and abroad, and of teaching first aid, supplying food and clothing to the destitute, training nurses' aids, etc. The civil-defense work and National Blood Program of the Red Cross are only two of its many humanitarian activities.

RED MEN, IMPROVED ORDER OF. About 1765 there was founded in Maryland a secret revolutionary society known as the Sons of Liberty. After the Revolution this benevolent fraternity continued, changing its name in 1813 to the Society of Red Men. Seventeen years later, the organization died

out. It was revived in 1833 at Baltimore as the present Improved Order of Red Men, functioning under the motto, "Freedom, Friendship, and Charity." Lodges are located in every state, in the Canal Zone, the Philippines, and Hawaii. The total membership is about 200,000.

A similar organization known as the Degree of Pocahontas has been set up for the women relatives of the Red Men. Lodges are held in halls known as "wigwams." Meetings are opened by the lighting of the council fire and closed by quenching the fire, according to the custom of the American Indians.

RED RIVER. Rising in the plains of Northern Texas, near the border of New Mexico, the Red River follows a southeasterly course. Forming part of the northern boundary of Texas and flowing across the corner of Arkansas into Louisiana, it crosses that state to its junction with the Mississippi. The Red River is navigable for about 500 miles of its 1,200-mile course, and it passes through dense forests and wide prairies. It is the southernmost large tributary of the Mississippi and has a drainage area of about 90,000 square miles. Its own chief tributary is the Washita River. Part of the waters of the Red River separate from the main stream a few miles above where it enters the Mississippi and flow south into the Atchafalaya Bayou and into the Gulf of Mexico. The principal cities along its banks are Shreveport, Natchitoches, and Alexandria.

RED RIVER OF THE NORTH. The valley of the Red River of the North, one of the richest agricultural regions in North America, is noted for the production of wheat. The river is formed by the junction of the Otter Tail and Bois de Sioux rivers and flows directly northward along the boundary between Minnesota and North Dakota to Lake Winnipeg, in Manitoba, a distance of 355 miles from its source. It is part of the Saskatchewan-Nelson system, and has a drainage area of about 63,400 square miles, most of which lies in the ancient bed of geologic Lake Agassiz. The

two most important tributaries are the Sheyenne and the Assiniboine. See MINNESOTA; MANITOBA.

RED RIVER REBELLION. Because they feared the loss of their land when the Canadian government planned a survey of its newly acquired territory in Western Canada, the Indians and half-breeds (métis) in the Red River Valley of Manitoba revolted in 1869-70. The land was previously owned by the Hudson's Bay Company, which had permitted the Indians to live there without securing titles to their property; but all the territory had been transferred to the British government in 1869, which had then turned the land over to the Dominion of Canada. The news of the intended survey created much excitement, which greatly increased when it became known that Hon. William MacDougall was to serve as governor of the new territory.

Louis Riel, who had been made president of a provisional government, took Fort Garry (now Winnipeg) and ordered MacDougall not to enter the territory. MacDougall complied, and the affair seemed destined for a peaceful settlement until Riel ordered the execution of one Thomas Scott. This action aroused great indignation throughout Canada. Colonel Garnet Wolseley, with a force of 700 men, marched into the territory to quell the revolt. Riel fled, and the rebellion ended after land was set aside for the Indians. See RIEL, LOUIS; SASKATCHEWAN REBELLION.

RED SEA. The water route from Europe to India and Asia passes through the Red Sea, which extends 1,450 miles from the southern end of the Suez Canal to Bab-el-Mandeb and the Gulf of Aden and separates Africa from Arabia. The traveler finds this one of the most unpleasant parts of the voyage, for the climate here is hot and humid, and even the water has a temperature of more than 80°F. Navigation is difficult on the Red Sea, for it is full of little volcanic islands, and coral reefs that extend along the shore.

At the northern end the sea has two

arms, between which lies the Sinai Peninsula, where, according to the Biblical account, the Israelites wandered for forty years. One branch, called the Gulf of Aqaba, extends into Arabia; the other is the Gulf of Suez, connected with the Mediterranean Sea by the Suez Canal. The western shore of the sea is low, while the Arabian shore on the east is high. Both shores are desolate and hot. The construction of the Suez Canal greatly increased the commerce of the Red Sea, since it replaced the route around the Cape of Good Hope and the dangerous overland caravan routes. This sea has borne the trade of the East since the beginning of history. See SUEZ CANAL.



BIRDLAND'S "LITTLE TORCH"

REDSTART. For color and grace, the redstart is probably the most conspicuous of the American wood warblers. Smaller than a sparrow, the male redstart is black on the upper parts and throat, and has six orange patches, one on each side of the breast, one on each wing, and one on each side of the base of the tail. The remaining under parts are white. The female is much less strikingly colored, being olive-gray instead of black, with the six patches yellow.

Redstarts winter in the West Indies, Central and South America, and in Cuba, where they have been given the name of *candelita*, "little torch." During the breeding season they are found throughout most parts of central and northern United States and central and southern parts of Canada. They prefer an open woodland with con-

siderable undergrowth. They are very active, continually fluttering about with spread wings and tail, looking very much like large butterflies.

REDWOOD. See SEQUOIA.

REED, STANLEY FORMAN (1884-). When President Franklin D. Roosevelt in 1938 appointed Stanley Reed to the Supreme Court bench, he chose a member of the liberal group of lawyers. Reed's views on constitutional law can be summarized in his own words, "If, by interpretations based on modern social and economic requirements, we can advance speedily toward our objectives, we can avoid the dangerous experiment of fundamental constitutional changes."

Justice Reed was born in Mason County, Ky., December 31, 1884. He was educated at Kentucky Wesleyan College and at Yale, and studied law at the University of Virginia, at Columbia, and at the Sorbonne in Paris.

During World War I he was a first lieutenant in the United States Army. He was elected to the Kentucky legislature in 1921. In 1929 Reed was called by President Hoover to act as general counsel of the Federal Farm Board, and was appointed to the same office for the Reconstruction Finance Corporation in 1932. President Roosevelt appointed him Solicitor-General of the United States, and in this capacity he ably defended many "New Deal" laws before the Supreme Court.

REED, WALTER (1851-1902). Yellow fever is no longer a scourge of the tropics. It was conquered when Walter Reed, a distinguished army surgeon, and three associates conducted experiments in Cuba which proved that the disease is transmitted from one person to another through the bite of a certain type of mosquito. By cleaning out the breeding places for mosquitoes, authorities rid Havana of yellow fever; and the knowledge of how to combat this disease made the construction of the Panama Canal possible.

Walter Reed was born in Gloucester County, Va. He attended the University of

Virginia, and studied medicine there and at Bellevue Hospital and Johns Hopkins University. The United States Army hospital at Washington, D. C., is called Walter Reed Hospital in his honor.

REFERENDUM, *ref ur en'dum*. When the people of a political unit vote upon an act, to decide whether or not it shall become a law, the election is termed a referendum. In other words, the proposed law is "referred" to the voters for approval or rejection. In political units where the referendum has been adopted, a bill passed by the legislative body is invalidated if the electorate refuses to endorse it. When the constitution of a state requires that all laws passed by the legislature be submitted to the people, the referendum is *obligatory*. When use of the referendum is left to the decision of the legislature, or when a voters' petition is required before a law can be submitted to popular vote, the referendum is *optional*. Closely allied to the referendum is the initiative (see INITIATIVE).

RE'FLEX ACTION. When something brushes one of our eyes, both eyelids immediately drop. When we chew our food, the glands of the mouth moisten it with saliva. When we exercise an arm, its blood cells become swollen, and if the exercise is strenuous, the heart beats with greater energy. All of these acts are reflex actions, taking place independently of our will. We may be conscious of our reflex actions, as when we quickly draw a hand away from a hot flatiron, or we may be unconscious of them, as when exercise stimulates the glands of internal secretion (see GLANDS). And if they are actions which we are able to perform at will, we may also be able to prevent their occurring as reflexes—to hold our eyelids when they are touched, for instance. But when they take place as reflexes, there is no mental effort involved.

The Explanation. In each case the stimulus (such as in contact of the skin with a hot kettle) is received by a nerve, carried to a central cell in or near the spine by a nerve known as an *afferent* (to-carrier), then carried from the cell by one or more



PROTESTANTISM DEFENDS ITS CAUSE

When Martin Luther was called by a council of the princes to meet the Papal delegate, Cardinal Cajetan (above), his protestations had far-reaching effects. Left, Philipp Melancthon, a Reform leader.

efferents (from-carriers). If a skeletal (bone-moving) muscle is affected, the efferent goes directly to it. If a gland, a blood vessel, or a heart muscle is to respond the efferent leads to a *ganglion*, or nerve center. See NERVOUS SYSTEM.

REFORMATION, *ref or ma'shun*, THE. Although it had smoldered for many years, the Reformation burst upon Europe in the sixteenth century with a suddenness that rocked the continent. It was the most stupendous religious upheaval in history, resulting in the permanent division of Christianity into Protestant and Catholic faiths and the loss of Catholic power in Northern Europe. In addition, it launched Western civilization on an era of bloodshed and internal strife that affected not only the

future of the nations involved, but the colonization of America as well.

The Reformation began as a reform movement within the Church and ended in a cleavage that could not be compromised. It took the form, actually, of three reformations: that of the nobles and princes of Germany, who threw off the power of the Church in state affairs; that of the common people, who tried to bring the Church back to the ideals of Christianity as set forth in the Bible; and that within the Church hierarchy itself.

Before Luther. From the time of Christ until the year 1500, Christianity had spread throughout Europe. But it had not confined itself simply to religion. The Pope had become the actual successor to the

emperors of Rome, ruling over the spiritual and temporal affairs of all Europe. The Pope, the archbishops, the bishops, and other high officials of the Church made alliances with princes and nobles, levied taxes, and forced their own policies on them. The monasteries, once the seat of learning and sacrifice, became wealthy and corrupt and in some cases bled the common people for money and treasure.

Princes, traders, and peasants resented this usurpation of power by the Church. It became inevitable that the princes and the traders should wish to reduce the power of the Church over their affairs. It was equally inevitable that the common people should wish the Church to pay more attention to them, to exercise the spiritual control that rested in the words of Christ.

Objections to the Church's power on the one hand, and its lack of power, on the other, had been voiced before 1500. In the fourteenth century, several rulers in Europe had made determined efforts to prevent the Pope's interfering too much in the affairs of their countries. Wycliffe, Huss, and Jerome had also urged reform in the Church on the grounds that it was not performing its rightful functions.

Causes. The Renaissance brought about one fundamental reason for the Reformation—it stimulated learning. This stimulation, combined with the invention of movable type, permitted the widespread distribution of the Bible and the works of Erasmus and other scholars. As more people read, more people began to think, to question, and then to doubt. They found that the teachings of the Bible were not always the same that the priests expounded from the pulpits. They read Christ's words and saw in them nothing that gave the monasteries the right to take their money and property or that gave the Pope and the bishops the right to desert them for power.

The direct cause of the Reformation, however, was the Church's need of money. Early in the sixteenth century, Pope Leo X sought to replenish the Papal funds by granting indulgences. Johann Tetzel was

commissioned to preach indulgences in Germany, where discontent was most widespread. The manner in which he did this angered a courageous and learned Augustinian monk of Wittenberg, by the name of Martin Luther. Luther, on October 31, 1517, dismayed at Tetzel's way of granting indulgences, posted ninety-five theses, or statements, on the door of the church in Wittenberg. The theses were not revolutionary. They merely condemned Tetzel for his actions and urged people to be more penitent and charitable. But they caused a great disturbance, nevertheless. They were printed and distributed widely. Many people supported Luther. Soon he went further and attacked the Church itself.

The German princes, eager to throw off the power of the Pope and seeing the way the common people wished to reform the Church, championed Luther, not for religious reasons but for political purposes. Luther was excommunicated, having refused to recant.

Events of the Reformation. The Reformation was now definitely launched. Luther continued his writings, and in 1521, Charles V, Holy Roman Emperor, summoned him before the Diet of Worms to recant. Luther refused, and, to prevent his arrest, Frederick, elector of Saxony, one of the German princes friendly to him, hid him in his castle. Adrian VI became Pope in 1522 and at first did not concern himself greatly with Luther's works. Then he ordered the Diet (council) of Nuremberg to take action against him. The Diet did little. Several years later, the friendly princes, sure that they had the support of the common people, organized an alliance, and a synod was formed to establish a doctrine of faith. Each congregation was to be given the right to govern itself. In the meanwhile, the Catholics had formed an alliance, too, and in 1529 the leaders of the two faiths were again summoned to a Diet, this time at Speyer. Here the followers of Luther protested the claims of the Catholics, and the name *Protestant* was given them.

In 1530 Charles V, still seeking peace, held the Diet of Augsburg, and the Protestants submitted their confession of faith, called the Augsburg Confession. Twenty-five years later the followers of Luther received their first legal recognition when, at Augsburg, the princes were given the right to choose between Catholicism and Protestantism. This action turned Germany into a checkerboard of Catholic and Protestant duchies. The condition existed until the nineteenth century, and so delayed the formation of a united German nation.

The Reformation Elsewhere. Although Germany was the fountainhead of the revolt that rent Christianity, the doctrines of Luther spread to other countries. In Sweden, King Gustavus Vasa adopted Protestantism for his country in 1527 and ordered the monasteries confiscated. In 1536 the authority of the bishops was abolished in Denmark. The new faith made progress in Hungary and Poland, but never succeeded in superseding Catholicism in the latter country. Italy and Spain remained Catholic, except for a few scholars. Ulrich Zwingli was the prophet of Protestantism in Switzerland, where a Reformed Church was adopted by Zürich, Bern, and other cities. Zwingli and Luther disagreed over technical details, but later the *Institutes of Calvin* were adopted by the churches there and were introduced into the Netherlands.

Strife between Catholics and Huguenots (Protestants) in France caused bloodshed and political turmoil. England underwent a reformation under Henry VIII, although Henry never renounced the Roman Catholic faith. After Elizabeth's reign, a period of religious strife began that led to persecutions and the eventual colonization of America. In Scotland the doctrine of the mass and the authority of the Pope were renounced by Parliament in 1560.

Results of the Reformation. The immediate result of the Reformation was the shifting of religious and temporal power of the countries of Northern Europe from

the Pope to the princes. This shift led to the formation of kingdoms in which the spiritual and political power was vested entirely in the king. History has shown that this setup was not to be permanent.

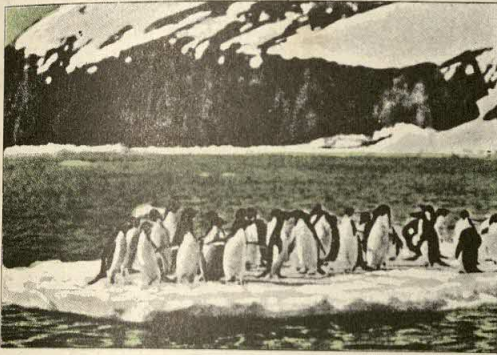
The common people, who had united with the princes, but for a different reason, were not so successful immediately. Their Reformation was a more honest one and, at the same time, more confused. But eventually they won what they wanted—a Church founded on the Bible and not on a hierarchy—and their gains, though long in coming, have persisted.

What of the Church itself? The Reformation had a worth-while effect on the Catholic Church. When its faults were exposed, it instituted reforms. The Popes no longer turned their attention only to political power but sought to be real spiritual leaders. The monasteries were reformed and again became places of good, instead of corruption. Perhaps the greatest effect was the formation of the Jesuits by Loyola. The organization had a profound, purifying effect on the Church and is one of the reasons the Catholic Church today is one of the great religions of the world.

For further information, consult:

Augsburg Confession	Luther, Martin
Calvin and Calvinism	Nantes, Edict of
Charles V	Pope
England, Church of	Protestants
Huguenots	Renaissance
Huss, John	Roman Catholic
Indulgence	Church
Jesuits	Thirty Years' War
Knox, John	Wycliffe, John
Loyola, Ignatius of	Zwingli, Ulrich

REFORMED CHURCH. Those Protestant groups which did not adhere to the doctrines and beliefs of Martin Luther at the time of the Reformation used the name Reformed Church, with some qualifying term. The name was first used by the French Protestants. Today, in the United States, there are a number of the Reformed Church in America (Dutch), the Evangelical and Reformed Church (German), the Christian Reformed Church (Dutch), and the Free Magyar Reformed Church in America (Hungarian).



Penguins' excursion on an ice cake.

Where Good Health means Keeping Cool

REFORM SCHOOLS. Industrial schools, or reform schools, are public institutions organized on the theory that many young people begin careers of crime and delinquency not because they are naturally criminals, but because their environment has been bad and their training inadequate. Young boys and girls found guilty of misdemeanors and crimes are sent to these institutions, where they are given moral guidance and vocational training, in the hope that they may become useful members of the community rather than habitual criminals. The object is not to punish an offender, but to seek to reform him through the development of his mental and physical abilities and by teaching him a useful trade.

The first such school in America was the House of Refuge, established on Randall's Island, New York City, in 1824. In 1876 the first state institution was organized at Elmira, N. Y.; and since then such schools have become very common. In the early schools only children were admitted, but the age limit has been increased to thirty years. Sentences are usually indeterminate; that is, inmates are released on parole as soon as they have shown a responsible interest in improving themselves and have learned a trade.

REFRACTION, *re frak'shun.* See LIGHT.



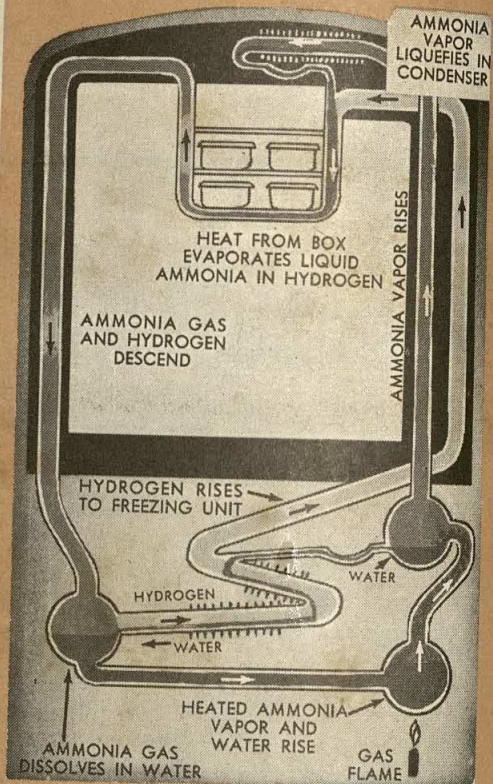
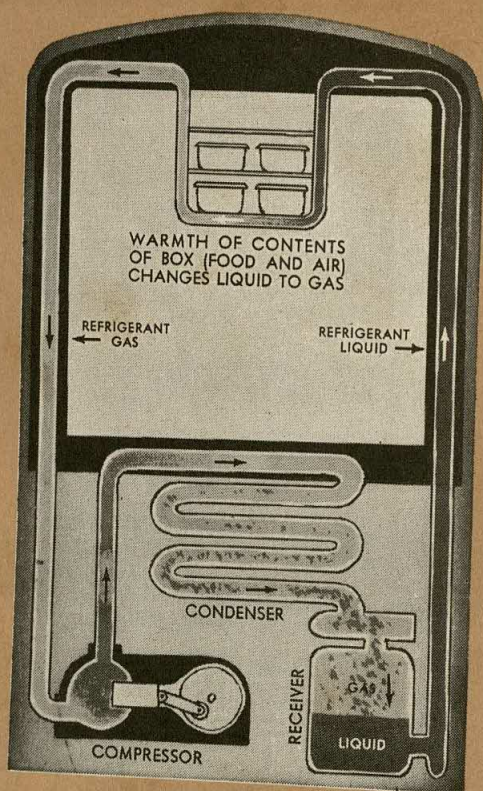
Nash-Kelvinator Corp.

REFRIGERATION, *re frij ur a' shun.*

In 1806 a Boston merchant, Frederick Tudor, began supplying New England ice to the West Indies. Soon his company was supplying such ports as Bombay, Calcutta, and Singapore. A patent obtained in 1838 shows him to be the originator of insulation for ice storehouse construction.

In 1834 came the first refrigerating machine, an invention that gave rise to the establishment of large cold-storage warehouses for storing perishable fruits, vegetables, and meats in large cities. Such warehouses were originally cooled by ice, but later ammonia was the usual refrigerant. Still later came the domestic electric or gas refrigerator, using carbon dioxide, sulphur dioxide, or one of various other refrigerants. Freezers are refrigerators capable of keeping the temperature at 0° F. or lower. They are used for storing frozen foods in stores and homes. Foods must be "quick frozen" at a temperature between 20 and 50 degrees below zero, Fahrenheit, to preserve their color, texture, and flavor. Ice is still used as a refrigerant, however, in

HOUSEHOLD ELECTRIC REFRIGERATOR



HOUSEHOLD GAS REFRIGERATOR

The electric refrigerator uses the compression system; the gas refrigerator, the absorption system. In the diagram above, the absorber is shown at lower left. Because it has no compression pump the gas refrigerator is silent.

cooling refrigerator ships and cars, and for homes which cannot afford a mechanical refrigerator.

All refrigeration is based on the fact that when a solid (such as ice) is changed to a liquid, or when a liquid (such as ammonia) is changed to a gas or a vapor, the process requires heat, which is taken from the surrounding area. This reduces the temperature of the air to a point where foods will keep without spoiling. See COLD STORAGE; ICE.

REGISTRATION, *rej is tra'shun*. Many laws have been passed to preserve the purity of the ballot, to the end that there may be an honest count of ballots honestly cast. Registration of voters, under rules prescribed by statute, is the means which thus far has proved most effective in identifying

and protecting those qualified to participate in elections, and to prevent fraud. Such laws are in force almost everywhere. One who wishes to vote must visit his polling place on a preceding specified date, and before his election board must make proper statements as to his identity and place of address.

When he votes on election day, his name is again entered on a register for such future reference as may be necessary, and a check is placed opposite his name on the registration sheets. Such regulations make it impossible, wherever the election board is honest, for a person to vote more than one time at an election, or to vote in the name of another person. Entirely new registration of all voters is required in some jurisdictions as frequently as once a year;



INDISPENSABLE TO ARCTIC DWELLERS

Reindeer furnish people of the Far North with meat, milk and clothing, and also serve as fleet and hardy beasts of burden. Here is a herd with its leader.

in others, at longer intervals. Where permanent registration prevails, voters need only report change of address or name, unless an entirely new registration list is compiled.

REICHSTADT, *rike' stah't*, NAPOLEON FRANÇOIS JOSEPH BONAPARTE, Duke of (1811-1832). Known as Napoleon II, Napoleon Francois Joseph Bonaparte was the son of Napoleon I and his empress, Maria Louisa of Austria. Upon his abdication after the Battle of Waterloo, Napoleon named his four-year-old son his successor, but the boy's claims were not recognized. The child was later taken to the court of his grandfather, Francis I of Austria. In the Treaty of Paris, he was barred from succeeding to the throne of France, but was created the Duke of Reichstadt, ranking below the Austrian archdukes. Never strong, he died at the age of twenty-one.

REIGN OF TERROR. See TERROR, REIGN OF.

REIN'DEER. Whether hitched to a sled or carrying a pack, the reindeer is a willing and efficient servant of man, and it also supplies milk, meat, and pelts. Thus it is "cow" and "horse," in one. Reindeer are creatures of far-northern lands. They are thickset animals with short, stout legs

and broad feet that enable them to walk more easily on the snow. Both sexes have antlers, those of the females being smaller and more slender than those of the males. Under domestication the original solid dull color has changed to variations with black and white in endless combinations.

The reindeer now found in Alaska and Canada are near relatives of the native wild caribou (see CARIBOU), but are descendants of small herds imported years ago from Northern Europe and Asia. They were introduced into Alaska in 1891 by the United States Bureau of Education, to provide a means of livelihood for the Eskimos, who were threatened with starvation. The Eskimos were taught how to care for the animals, and conditions of food and climate were so favorable that the reindeer multiplied rapidly — from some 1,200 imported to many thousands. In the 1930's Canada introduced a large number of the animals into its Arctic areas for the benefit of the natives living there. The reindeer feed on lichens, moss, and other Arctic vegetation. They are as valuable to the Lapps and Eskimos as the camel is to the desert dweller. See ALASKA; LAPLAND.

RELATIVITY, THEORY OF. See EINSTEIN, ALBERT.

RELIGION, *re li'jun*. Man, in every stage of his advancement and culture, has expressed his deepest needs through religion. In the belief in some power, whether it be an immortal being, a spirit, an animal, an idol, or the forces of nature, man believes that he finds the answer to questions he himself has been unable to solve. In such a belief he searches for the solace he needs in sorrow, the strength he requires in weakness, the certainty he lacks in a confusing and uncertain world. The regular practice of his faith is his religion, and it may range from the elaborate ceremony and ritual of the Roman Catholic Church to the simple practice of meditation in an easy chair.

Although in its broadest sense religion is simply the expression of a relationship with a supreme power, man has always made religion a formal process. It is true of the most civilized person and the most barbarous savage, and today we find most people practicing the belief in one or more supreme beings according to ceremony. Those who believe in one supreme being, or God, have a *monotheistic* (one God) religion; those who believe in more than one supreme being adopt a *polytheistic* (more than one God) religion.

Within these two broad classifications, religions can be separated into four categories: (1) the religions of savages; (2) the religions of primitive culture, such as those of ancient Mexico, Peru, and the South Sea Islands; (3) the religions of advanced culture, such as were practiced in Egypt, Assyria, Babylonia, Greece, and Rome; and (4) the religions that are co-extensive with life, such as Christianity, Buddhism, Mohammedanism, and Judaism.

Worship of such things as stars, the sun and moon, rivers, trees, and spirits of ancestors, as well as the practice of magic, are characteristic of the first two groups. Mythology is a factor in the religions of the third group. The religions of the last group deal with morals and manner of living, and man's relation with the spiritual and divine; thus these religions exert a tre-

mendous influence on the world of today.

The principal religions in the world and the approximate number of followers for each are: Christianity, 742,000,000; Confucianism and Taoism, 350,000,000; Mohammedanism, 316,000,000; Hinduism, 256,000,000; Buddhism, 150,000,000; Shintoism, 25,000,000; Judaism, 11,000,000; Zoroastrianism, 125,000; primitive religions, 121,000,000; and unclassified, 347,000,000.

For additional information, consult:

Brahmanism	Hindu and Hinduism
Buddhism	Mohammedanism
Christianity	Mythology
Confucius	Shintoism

RELIGIOUS LIBERTY. Ever since Old Testament days, men have been persecuted for trying to exercise the right to worship according to their beliefs. Many wars have resulted from the efforts of church or state to impose restrictions on religious liberty.

Freedom of worship is incorporated in the Bill of Rights of the Constitution of the United States. A cherished privilege, it followed the growth of democracy in the nineteenth century, and became a cardinal principle in England. During the 1600's, England had forced dissenters from the Established Church to flee to the New World, and had refused Catholics the right to hold seats in Parliament. Religious freedom also took root in Catholic France, which had massacred and exiled Huguenots in the 1500's.

In the twentieth century, the doctrine of religious liberty became a burning issue in countries with totalitarian governments, such as Germany and Italy. The Soviet Union encourages atheism, and religious freedom has suffered in all Communist states. Totalitarian governments oppose freedom of worship because it sets up an opposing force to government.

REMBRANDT, full name REMBRANDT HARMENSZ VAN RIJN (1606-1669), was one of the greatest painters of all time. A master portraitist, he showed in all his work an unmatched use of light and dark.

A native of Leiden, Holland, Rembrandt went to Amsterdam, the Dutch art center,



John Hancock Mutual Life Insurance Co.

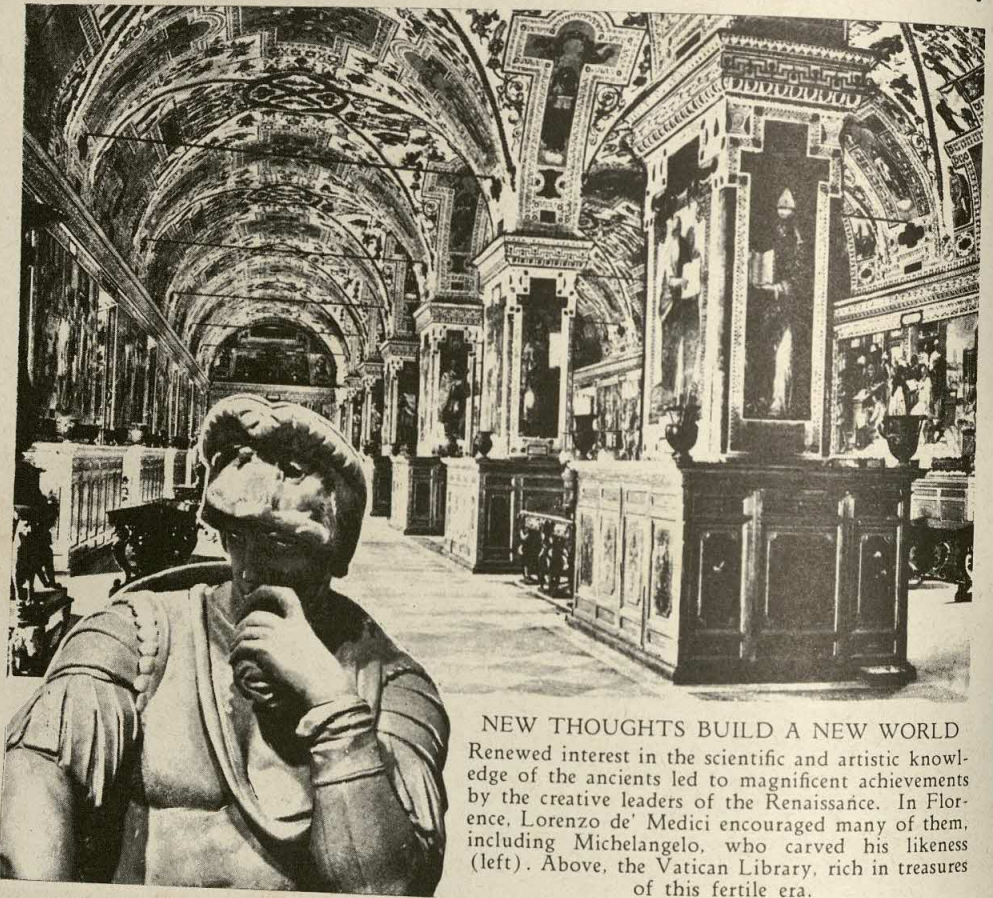
FAITH MADE THEIR HARDSHIPS EASIER TO BEAR

Early American pioneers depended on their minister in times of trouble and he served them well—most of the time as their minister, but often also as a judge or teacher or doctor. In every country, in every period of history, religious belief has given people strength to do what they felt they could not do alone.

at the age of twenty-five. Throughout his life, he experienced both wealth and poverty, but at no time sacrificed his principles of art to please his critics. As a result, his work often failed to receive due praise, and much of it was sold to pay his debts. Today, an original Rembrandt is worth thousands of dollars, and his most famous works are

priceless. A few are owned privately, but most are in museums.

Rembrandt's talents as a portraitist and etcher won him early fame, and he soon became prosperous. It was at the peak of his popularity that he painted the most famous of his canvases, *Night Watch* (actually, a picture of the civic



NEW THOUGHTS BUILD A NEW WORLD

Renewed interest in the scientific and artistic knowledge of the ancients led to magnificent achievements by the creative leaders of the Renaissance. In Florence, Lorenzo de' Medici encouraged many of them, including Michelangelo, who carved his likeness (left). Above, the Vatican Library, rich in treasures of this fertile era.

guards issuing from their clubhouse). This magnificent picture was disappointing to the persons in it, because it did not flatter them, and the artist's popularity soon declined. Yet Rembrandt went on turning out beautiful canvases that today are treasured for their deep, rich browns and contrasting colors.

Rembrandt's *Night Watch* now hangs in the Royal Museum of Amsterdam, along with *The Syndics*, showing a group of Dutch merchants. Some of his other well-known paintings include *The Anatomy Lesson*, *The Supper at Emmaus*, *Old Woman Cutting Her Nails*, and *The Auctioneer*. His best-known landscape, *The Windmill*, is in the Widener collection, Philadelphia. Among his etchings are *Christ Healing the Sick*, *The Descent from the Cross*, and *The Burgomaster Jan Six*.

RENAISSANCE, *ren na sahnz'*. After years of darkness, Europe found itself in an era of brightness and activity in the middle of the fifteenth century. Everywhere men were reading, discussing, studying, painting, building, and creating. Old ideas were being discarded and new ones adopted. The literature and art of the ancients were being revived, and men dared to challenge the ideas of the Middle Ages. People began to regard themselves as individuals and to study themselves as such. They saw themselves as many-sided creatures and became interested in many things at once.

This activity was the Renaissance—the "new birth."

The Renaissance did not dawn upon Europe suddenly. Rather, it developed gradually from a number of causes. One

"MODERN" INVENTIONS BY THE GIANT OF THE RENAISSANCE

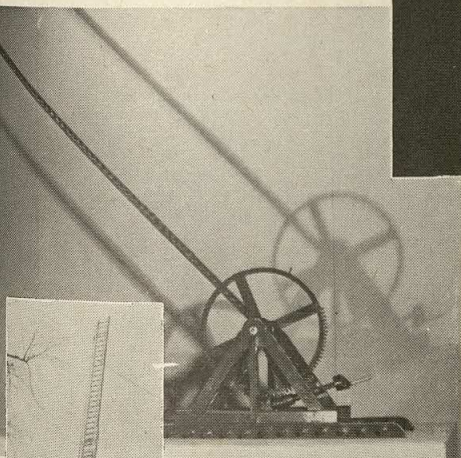
Leonardo da Vinci created not only great art,
but also astounding scientific inventions.



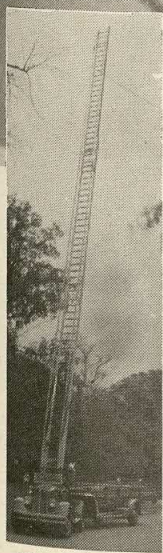
Da Vinci made a successful
jump with his "tent of linen."
It was the forerunner of the
modern parachute.



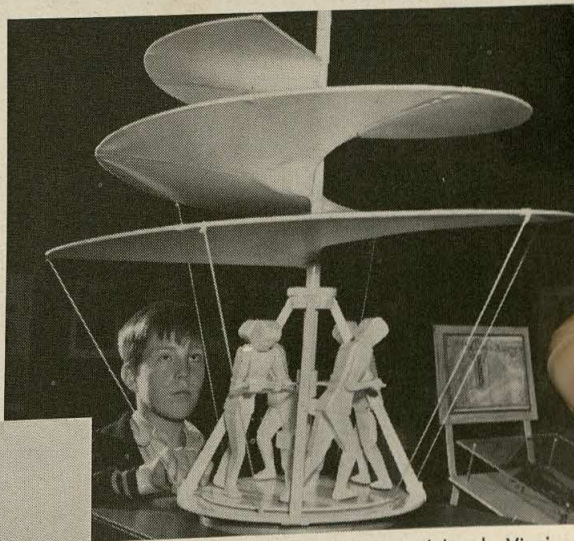
The flier was supposed to flap the wings of
da Vinci's "flying machine" with his feet.



Da Vinci's ladder for scaling
walls looked much like ladders
on fire-fighting trucks today.



International Business
Machines;
Signal Corp. Wide
World; Boeing
Airplane Co.



The "aerial screw" invented by da Vinci
is the forerunner of both the helicopter
and the propeller.





Mellon Collection, National Gallery of Art

BOTTICELLI'S THE ADORATION OF THE MAGI

Botticelli and other Italian Renaissance artists brought color, perspective and humanism into art. They made ancient Bible scenes look like those of then-modern Italy.

cause was the effect of the Crusades, which impoverished the nobles and encouraged the growth of towns and kingdoms, thus destroying feudalism and creating a money economy. This new economic system was the basis of the Renaissance. It was the beginning of capitalism, and it created a leisure class which was necessary to the pursuit of knowledge and the arts which characterized the period.

Another cause was the Black Death, which served to uproot thousands of persons from their homes on feudal estates and send them off to the towns and even to other lands to overcome the labor shortage occasioned by the plague. These people brought new ideas and, torn away from bondage to the soil, felt themselves free to do as they pleased.

When Constantinople fell to the Turks, in 1453, the scholars of that city fled to the cities of Western Europe, and their learning went with them. The invention of movable type at about that time made possible a wide distribution of learning, and civilization shook off the shackles that had bound it since the fall of the Roman Empire.

It is difficult to find an exact definition of the Renaissance. It was a period of

change, of growth. Life in the Middle Ages was based on faith, and life in the modern era is founded on knowledge. The Renaissance was midway between the two, spiritual beliefs and old customs combining with a belief in self and a free pagan spirit. Instead of man's regarding his existence on earth as merely a prelude to an afterlife, as he did in the Middle Ages, he came to place more value on his earthly life.

It must be remembered that such an attitude did not affect all the people in Europe. It was confined, for the most part, to a certain class created by the new economic conditions. In Italy, where the Renaissance first appeared in the thirteenth and fourteenth centuries because the Italian cities were the leaders in trade, this class was a new aristocracy. In Florence it was an aristocracy of intellectual attainment, whose members were regarded as superior to the great mass of people who tilled the soil and ran the shops. In Padua the aristocracy was one of moral achievement.

The Renaissance in other countries took different forms. In the Netherlands it affected the middle classes more than in Italy. France adapted the new way of thinking and living to an aristocracy that



FOUR WHO FIGURED IN THE PERIOD OF "NEW BIRTH"

From left to right, Boccaccio, whose poetry and prose brightened Italian literature; Leonardo da Vinci, rare combination of the arts and sciences, an outstanding genius of all time; Michelangelo, greatest of Renaissance sculptors and painters; Erasmus, the humanist.

already existed. In Germany, Italian thought was not so dominant; but in England it was developed by such philosophers as Bacon to include all people, not just a few. The Renaissance, then, in England was a definite stimulus to democracy.

From about 1300 to approximately 1600, the various countries of Europe seethed with this combination of the old and the new. This "humanism" was generalized, a factor that was responsible for the great output of poetry and art. In Italy, particularly, was it true, for there such men as Leonardo da Vinci, Michelangelo, Raphael, Ghiberti, Correggio, Donatello, Brunelleschi, the Medici, and Cellini brought the flower of the Renaissance to its more colorful bloom.

The Renaissance itself was not based on a scientific approach to knowledge, but it laid the groundwork for the modern era. The wide interest in everything—the desire to know and to learn—finally led to specialization; and in the seventeenth century the features of the Renaissance began to disappear in favor of an era of science.

For additional information, consult:

Calvin and Calvinism	More, Thomas
Cervantes Saavedra	Painting
Copernicus, Nikolaus	Petrarch, Francesco
Dürer, Albrecht	Printing
Galileo	Raphael Santi
Holbein (Elder and Younger)	Reformation, The
Luther, Martin	Tasso, Torquato
	Wycliffe, John

RENT. A person not versed in the science of economics, or political economy, assumes rent to refer to the sum paid monthly to the owner of the house in which a tenant lives. The tenant on a farm thinks of rent as the amount he pays to the owner of the land and buildings for the privilege of living there and raising crops and domestic animals for the support of himself and family.

To students of economics, however, rent means something more technical. There are three sources of wealth in the world—*land, labor, and capital*. But the one original source of all wealth is land; on it is the first expenditure of labor, and from it

come the raw materials of production. Economists declare that the share the land receives from the things which produce wealth is measured by a term called rent. If land can produce nothing, it can return no rent; rent is in proportion to productive value. To the economists, rent applies only to land. They consider that payments for the use of buildings are interest on capital investment.

The amount of rent for real property is influenced by quality, location, and demand. A fertile farm, far from transportation, may bring rent as low as a poorer farm near rails and roads; a modern factory in a wilderness may not get so high a rent as a loft in a large city; and a quality home in a settled district may command only low rent because of a saturated housing condition in that community. See **REAL ESTATE**.

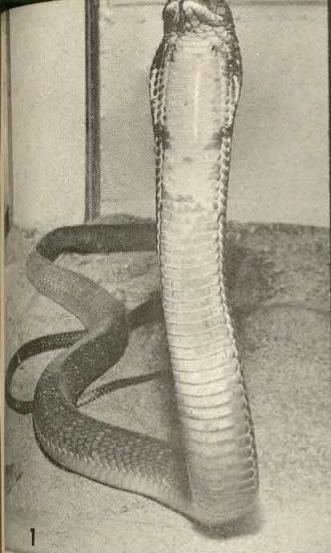
REPRESENTATIVES, HOUSE OF. See **CONGRESS OF THE UNITED STATES**.

REPTILES, rep'tilz. The reptiles best known are snakes. Other more or less familiar reptiles are lizards, turtles, alligators, and crocodiles. All of these creatures are so much alike in some respects that scientists have considered them members of a common group, the class *Reptilia*. All of them are cold-blooded; that is, their bodies do not keep a uniform degree of warmth as our bodies and the bodies of birds do. Like salamanders and frogs, many reptiles have four limbs, each with fingers or toes. Unlike most frogs and salamanders, reptiles have their bodies covered with scales and breathe air by means of lungs from the time they leave the egg or are born. Many reptiles spend their entire lives on dry land.

Reptiles are not popular with most people because it is commonly believed that most of them are poisonous. As a matter of fact, very few are at all dangerous to man and many of them are really useful.

Consult the following titles for descriptions of various reptiles:

Alligator	Boa
Anaconda	Chameleon



1



2

REPTILES — THE COLD-BLOODED ONES

All reptiles have scaly bodies and most have long tails. (1) Cobra—a poisonous snake of Asia and Africa. (2) Desert tortoise—his ribs form his shell. (3) Collared lizard, or mountain boomer—colorful and harmless. (4) American alligator—has tough hide and bad temper, (5) Five-lined skink—the adult male loses his stripes and becomes a redhead.

Zoological Society of San Diego

U.S. Fish and Wildlife Service

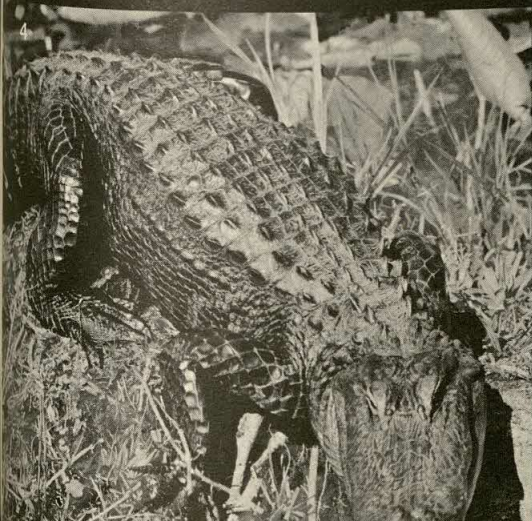
U.S. Fish and Wildlife Service

Jack Dermid

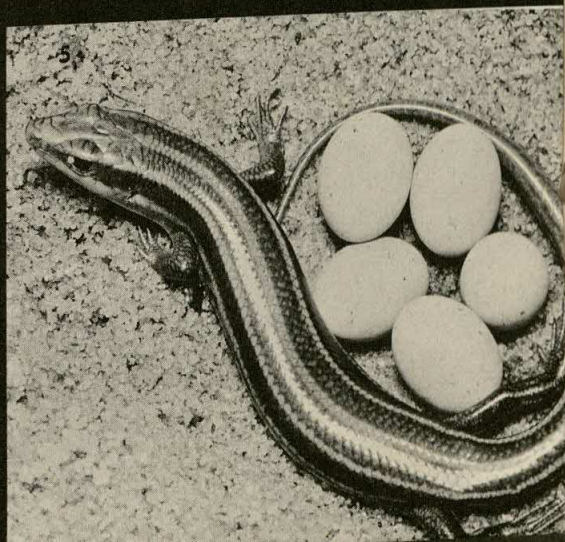
Jack Dermid



3



4



5



Travelers Insurance Company

WONDERS OF REPTILE WORLD

Snakes have some unusual variations in the shapes of their noses and in their means of self-protection. The puff adder (above) is also called the hog-nosed snake because its nose turns up sharply like a pig's. It will puff up, hiss, strike out, writhe as in agony, and even appear lifeless while trying to bluff an enemy. The leaf-nosed snake (right) has a broad flat snout enlarged to resemble a leaf. The green snake (below) depends upon his leaf-green coloring to make him almost invisible in foliage.

Jack Dermid

New York Zoological Society



Cobra	Lizard
Copperhead	Moccasin Snake
Crocodile	Python
Dragon	Rattlesnake
Garter Snake	Terrapin
Gila Monster	Tortoise
Iguana	Turtle
Leatherback	Viper

REPUB'LIC. See GOVERNMENT.

REPUBLICAN PARTY. See POLITICAL PARTIES IN THE UNITED STATES.

RESERVOIR, *rez' ur uvor.* An important part of many city water-supply systems, as well as an essential feature of the great irrigation projects of the Western states, is the reservoir, an artificial basin where a large quantity of water can be stored. The embankments and dams which form the reservoir are usually built of masonry or earth, and their construction requires great engineering skill. Earth embankments are frequently used because of their greater economy. When a reservoir is constructed of earth, it must be provided with a waste weir to get rid of surplus water; otherwise the additional pressure would damage the work. This precaution is not necessary in masonry construction, because the water may be permitted to overflow the walls without damage to the structure.

Examples of large reservoirs connected with city water systems are the Ashokan and Croton reservoirs in the system which supplies New York City. The greatest reservoirs are connected with irrigation projects.

For further information, consult the following articles:

Aqueduct	Reclamation, Bureau of
Irrigation	Waterworks

RESINS, *rez'inz.* The hardened drops of gum which collect on the trunks of evergreen trees are probably the most familiar examples of a resin. Most resins do come from trees, although a few are of animal origin. If they are mixed with essential oils, as in the sap of pine trees (see **TURPENTINE**), they are known as *oleo-resins*. If they contain gum, as the drops which harden on the trees do, they are *gum resins*. In any case, if the resin itself

is separated, by distillation or other process, it usually hardens into a transparent or semi-transparent mass, which is brittle like glass.

Chemically, no two resins are alike, though all contain carbon, hydrogen, and oxygen. Some are hydrocarbons and, therefore, similar to petroleum. The resin with which we are most familiar is rosin, secured in the distillation of turpentine. Kauri gum, or copal, used in varnishes, and amber are fossil resins; that is, they were produced by trees now extinct. Asphalt is probably also a fossil resin. An important resin of animal origin is lac, used in shellac and lacquer (see **LAC**). Resins are non-conductors of electricity at ordinary temperatures.

Synthetic Resins. One of the most interesting and most important achievements in modern chemistry has been the development of various substances to take the place of natural resins, the supply of which is limited and diminishing. Many of these synthetic resins have valuable qualities not possessed by vegetable and animal resins. Some are but very slightly affected by water, weather, dampness, oils, alcohol, acids, turpentine, or gasoline; they resist electricity and have great chemical inertness (that is, they will not readily take part in any chemical reaction); they do not soften at any temperature and they are not inflammable. They are particularly suitable materials for objects which must be very accurately molded, and are used in synthetic plastics. See **PLASTICS**.

RESOLUTIONS OF 1798. See KENTUCKY AND VIRGINIA RESOLUTIONS.

RESPIRA'TION. See BREATHING.

RESTORATION, *res toh ra'shun.* England returned to a monarchical form of government in 1660 after being without a king for eleven years. Charles II, son of Charles I, who was beheaded in the civil war, was restored to the throne, and his return has come down in history as the Restoration. With the return of the Stuarts, poets, prose writers, and playwrights found favor, and there was an era of Restoration literature.

See COMMONWEALTH OF ENGLAND; CROMWELL, OLIVER; LITERATURE.

RESURREC'TION PLANT. See JER-CHO ROSE.

RETRIEVER, *re tré'vur*. Dogs trained to bring in birds after they have been shot are retrievers. These dogs weigh about seventy pounds each. Their bodies are covered with a dense mass of hair, through which the water does not seem to penetrate, and outside the first coat there is one of curly hair from which the water can be easily shaken. The dogs are hardy and seem to enjoy swimming in icy water, if necessary even chasing wounded ducks under the ice.

REUNION, *ra u nyohN'*. One of the Mascarene group, Réunion is an island in the Indian Ocean belonging to France. It is about 400 miles southeast of Madagascar. Réunion is mainly a plateau whose surface is broken by volcanic mountains, of which Fournaise is active at intervals. The highest point is Piton des Neiges, 10,069 feet, an extinct volcanic crater. The island has an area of about 970 square miles. Climate and soil favor the production of large crops of sugar cane, vanilla, cacao beans, and coffee. Most of the products of the island are exported to France through the chief ports of Saint Denis, the capital, Saint Louis, Saint Pierre, and Saint Paul. The population is about 242,000, chiefly French. The island became an overseas department of France in 1947.

REVELA'TION, Book of The last

book of the Bible is *The Revelation of Saint John the Divine*, also known as the *Apocalypse*. It was in earlier times supposed to have been written about A. D. 90 by the Apostle John while he was in exile on the island of Patmos, but recent students question whether or not he was the author.

The book is in the form of a letter addressed to the Christian Churches in Asia Minor. It relates the author's visions of Christ, the kingdom of Heaven, and the coming judgment. Highly figurative language is used; and because of its unusual character, the book has furnished a fertile field for controversy and differences in interpretation. One school believes that it was intended to carry an immediate message to the Christians of that day, encouraging them to endure persecution for the sake of the glory which was immediately ahead; another believes that the book contains revelations of the coming of a heavenly kingdom still far in the future.

REVENUE CUTTER SERVICE. See COAST GUARD.

REVERE, *re veer'*, PAUL (1735-1818). Longfellow's poem, *The Ride of Paul Revere*, has made the name and exploit of this American hero known to everybody. On the night of April 18, 1775, he rode from Boston to Lexington to warn the minutemen of Concord and Lexington of the approach of the British, and his warning made the first battle of the Revolution an American victory.

John Hancock Mutual Life Insurance Co.

"TO ARMS! TO ARMS! THE BRITISH ARE COMING!"

The midnight ride of Paul Revere is one of the unforgettable highlights of American history.



Born in Boston, Paul Revere became a goldsmith, silversmith, and copper engraver, and it was he who designed and printed the first paper money authorized by the Continental Congress. He was a

leading participant in the Boston Tea Party, and was active in the Boston League, a Revolutionary organization. When the Revolutionary War began, Revere became a lieutenant colonel in the colonial army.

Independence for American Colonies

REVOLUTIONARY WAR IN AMERICA. Fifty states form one of the wealthiest and most powerful nations in the world—the United States. But these fifty states started with only a handful of men in thirteen English colonies—men who dared to go against the mighty strength of England.

Why It Was Fought. Three things were responsible for the Revolutionary War. One was the colonial policy of Great Britain. It had been based on trade and commerce before the French and Indian Wars (see FRENCH AND INDIAN WARS). Now England wanted more territory and wanted to keep all colonies under tight control.

Another cause for the war was the change in the colonists' political thought. The English Parliament had absolute control over laws and taxes. The American colonists thought they should have the right to take care of their own laws and taxes.

England's statesmen provided the third reason for the revolution. The American colonial farmers and tradesmen wanted to be left alone, to enjoy their rights and freedom in the New World. But the English Parliament continued to pass laws that hurt colonial trade. One was the Sugar Act in 1764. This led to the famous war cry, "No taxation without representation." The Stamp Act of 1765 was an additional tax that ordered stamps to be placed on business and legal papers. This angered the American colonials even more and many joined the "Sons of Liberty" in protest.

On March 5, 1770, several men were killed in the Boston Massacre. Three years later the British East India Company received the sole right to sell tea to the colo-

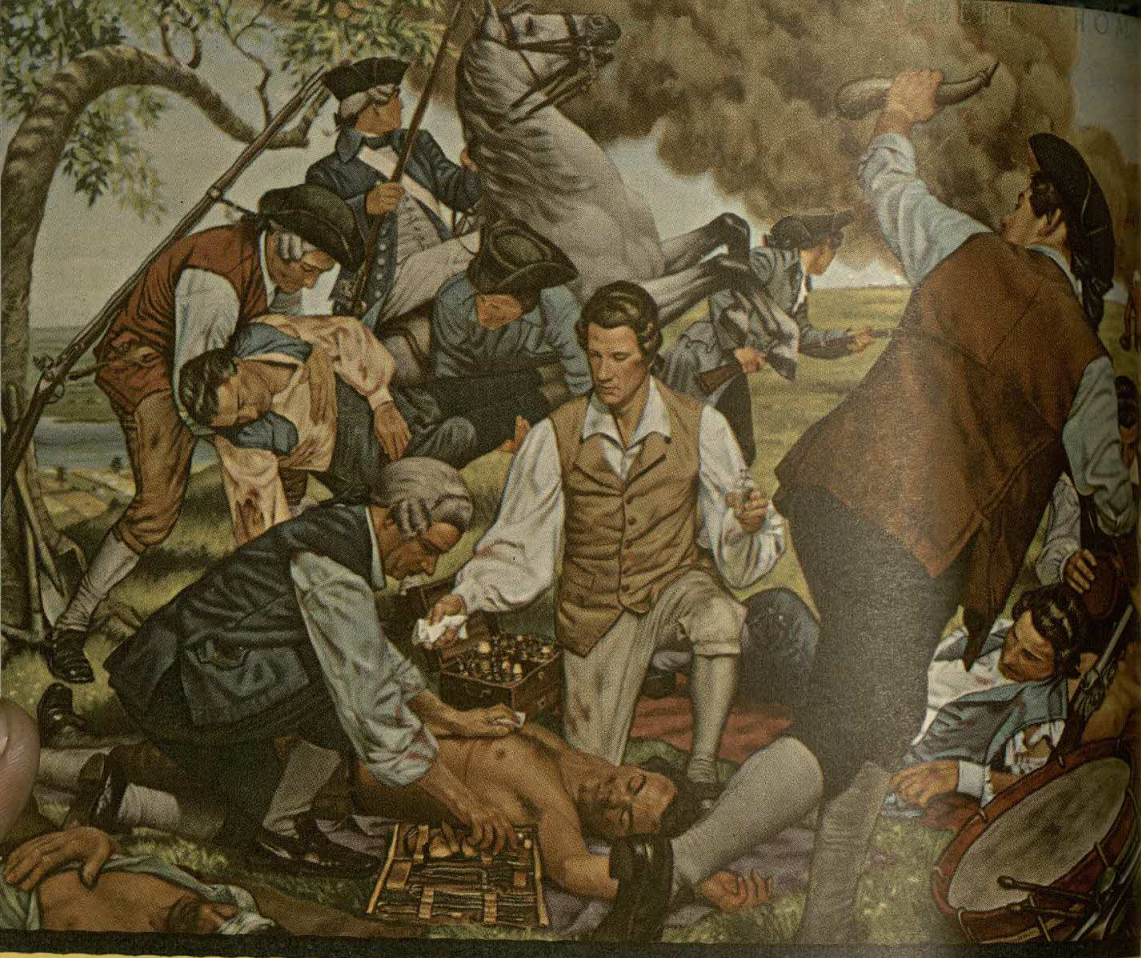
nies, and the result was the famous Boston Tea Party. England then closed the port of Boston. Agitators, led by Samuel Adams and Patrick Henry, made much of these blunders. Tension increased; and finally war began when British regulars and colonial minutemen clashed at Lexington and Concord on April 19, 1775.

Events of the War. The colonists did not declare their independence after the Lexington and Concord clashes. In fact, there was no popular uprising during the war. When Washington became commander in chief on June 15, 1775, he had only a small army. He never had more than about 22,000 men at one time, although there were 300,000 men capable of carrying arms. Volunteers deserted; uniforms were frequently lacking or in rags; food, shoes, ammunition were in short supply. Many American farmers even sold food to the British.

Yet Washington, with almost superhuman skill, whipped together a staff of capable officers and a band of 3,000 loyal soldiers. These men, with the aid of brilliant retreats, French help, guerilla warfare by frontiersmen, and the blunders of the English, managed to win out.

The English, too, had their troubles. They were fighting 3,000 miles from home, in a region that hindered the customary tactics of war. There was no central city or river that controlled the colonies.

English Versus English. At Bunker Hill on June 17, 1775, the British suffered heavier losses than in most of the Seven Years' War. Fort Ticonderoga fell to Ethan Allen on May 10, and the following day Seth Parker captured Fort Crown Point.



Treating Wounded at Battle of Bunker Hill

FREEDOM MEANT MORE THAN LIFE IN SIX-YEAR STRUGGLE

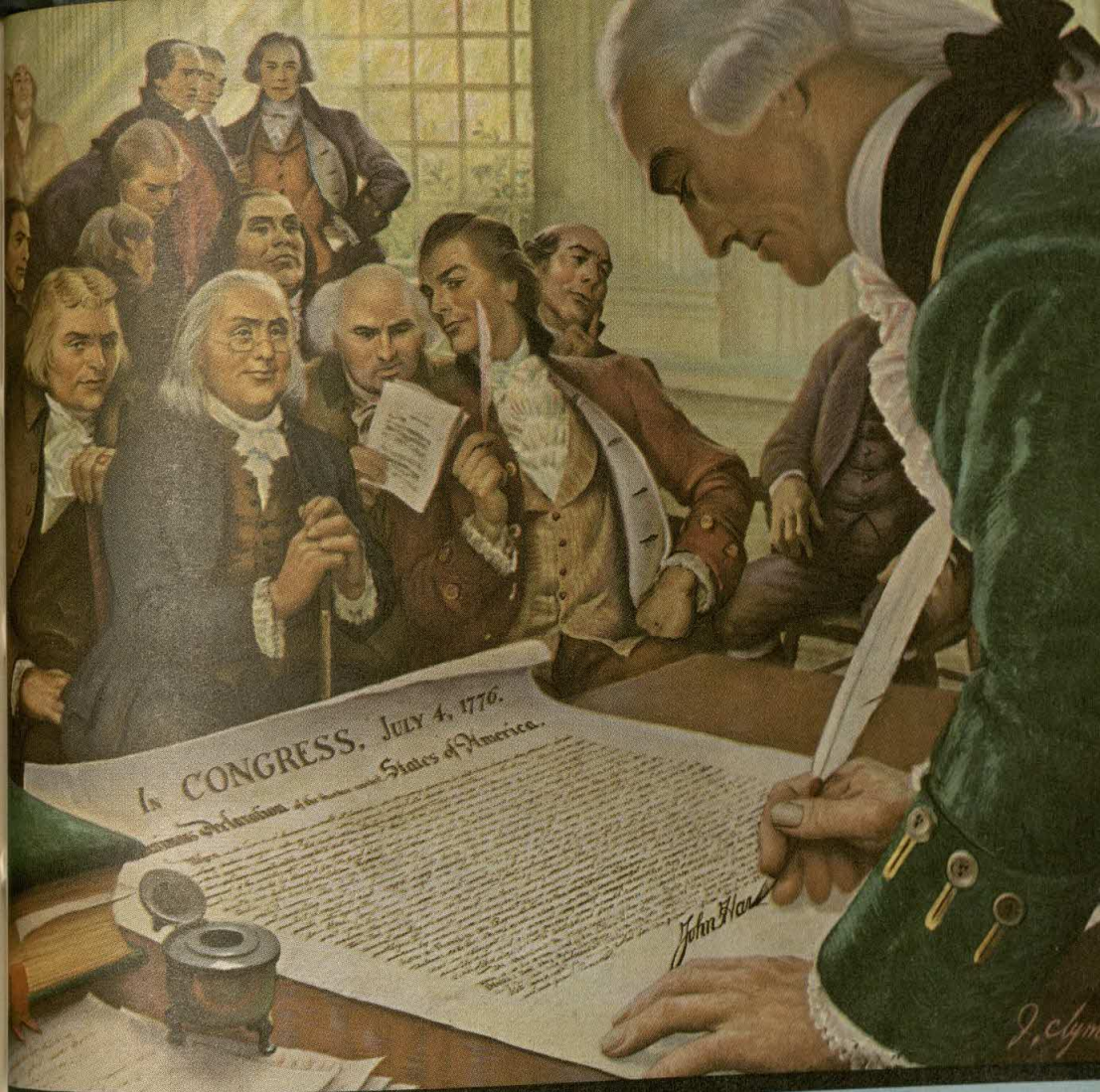
Above, from one of a series of oil paintings, "A History of Pharmacy in Pictures," commissioned by and copyrighted by Parke, Davis & Co., reproduced by special permission. George A. Bender, project director; Robert A. Thom, artist.

Later in the year, the Americans invaded Canada, failed to capture Quebec, but captured Montreal. Meanwhile, Washington in New York City prepared for the British, who had failed in their attack on Charleston, S.C.

The war took on a deeper significance when the colonies declared their independence on July 4, 1776. The fight was now for freedom and a new nation. After losing the Battle of Long Island, Washington was driven across New Jersey to Pennsylvania, resulting in the loss of Forts Mifflin and Red Bank. The American cause seemed lost

as its troops were forced to retreat to the south. They were hard pressed by Howe who planned to take Philadelphia. Actually the retreat gave Washington two outstanding victories: one at Trenton, New Jersey, in which he captured a troop of Hessians while they were celebrating Christmas Eve; the other victory at Princeton on January 3, 1777. These successes practically freed New Jersey from the British. A French force, led by Lafayette, also arrived to help.

The year 1777 was important. Howe took Philadelphia, the capital of the colonies;



When Freedom Wrote in a Big, Bold Hand

THE SIGNING OF THE DECLARATION OF INDEPENDENCE, JULY 4, 1776

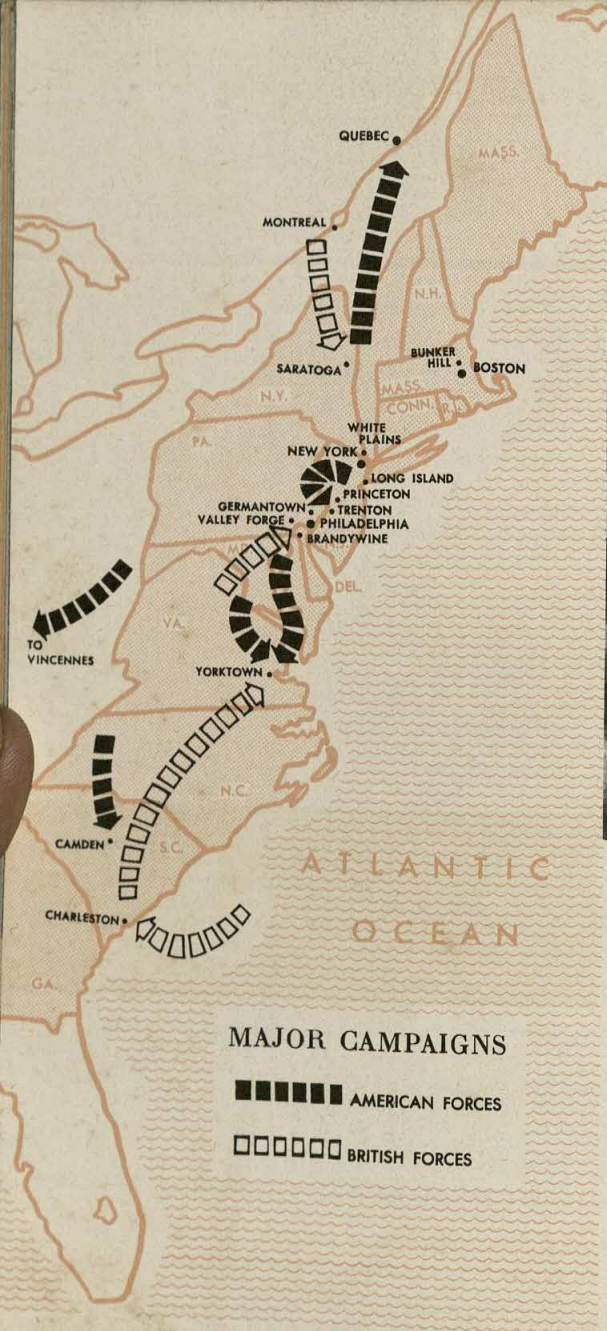
The days of talking were over. This was the time for decision. The silence of the big room in Philadelphia was broken only by the scratching of the pen. The bold signature John Hancock affixed to the document symbolized the defiant spirit of the American colonists.

John Hancock Mutual Life Insurance Co.

and, following Brandywine and Germantown, victory again seemed within his grasp. But again he went into winter quarters; and Burgoyne, who had come down from Canada was forced to surrender to Arnold and Gates at Saratoga on October 17. His surrender placed New England

entirely in the control of the colonies.

But, despite this triumph, the American troops still had their troubles. At Valley Forge, in the winter of 1777-78, the army nearly froze. Hundreds deserted; food and clothing were scarce. Political bickerings and jealousies almost destroyed the unity of



the colonies. Fortunately, the year 1778 promised some hope. On February 6 France recognized the independence of the colonies and pledged aid. George Rogers Clark won the West for the colonies with victories at Kaskaskia, Cahokia, and Vincennes. In addition, General Clinton, who had replaced Howe, evacuated Philadelphia. On the sea, American privateers were



John Hancock Mutual Life Insurance Co.

ACTION ON LAND AND AT SEA

Above is the great naval hero, John Paul Jones, who invaded enemy waters to harass British shipping. The map at left shows the major troop movements of the Revolution and locates the towns and cities that were scenes of important military engagements during the conflict.

causing great damage, and in 1779 the colonies hailed the victory of John Paul Jones in the battle between the *Bon Homme Richard* and the *Serapis*.

Gates led an expedition into the South in 1780, but that inferior general was routed in a battle near Camden, S. C. Nathanael Greene replaced him, and the fortunes of the colonies then took a decided turn for the better in the South, the only place where the war was still being waged. After a series of successful campaigns, aided by frontiersmen, Greene forced Cornwallis, commanding the British in the South, into Yorktown, Va. When Washington and Rochambeau, commander of the French forces, heard that the French fleet had defeated the English and had sailed to the Chesapeake to shut off Clinton's aid for Cornwallis, they hurried from

the Hudson to Yorktown. Here Cornwallis surrendered on October 19, 1781. This surrender ended the war. The South was safe. The North and West had already been taken by the Americans, and only New York remained in the hands of the British.

Washington, with only a skeleton army, waited outside New York for two years, but the British made no attempt to fight. Finally, in November, 1782, the terms of peace were agreed upon, and on September 3, 1783, the treaty was signed at Paris. The army had been disbanded on April 19, 1783, exactly eight years after the first bloodshed. In November, 1783, New York was evacuated by the British. The American colonies were now free and independent.

Results of the War. The war had, however, made the country poor. True, some men became wealthy from the usual war profiteering, but many were bankrupt. The paper currencies of the Confederation and the several states were practically worthless. Prices rose abnormally, causing real distress up and down the seaboard. The Confederation had no power to raise money by taxation.

In addition, the thirteen states were denied reasonable trading privileges with England, which now regarded them as foreigners. France, too, withdrew her trading privileges to Americans. A severe depression, such as always follows a major war, occurred in 1785, and it appeared for a time that the liberty achieved by the colonies was to result in anarchy. In 1787, however, a convention was called in Philadelphia, and there the Constitution was drawn up, forming the United States of America. Thus the Revolutionary War, despite the sad economic results, actually did bring about the formation of a new nation, and in a few years the Americans began to prosper.

For additional information, consult the following articles:

HISTORICAL ARTICLES

- | | |
|------------------|----------------|
| Boston Massacre | Confederation, |
| Boston Tea Party | Articles of |
| Committees of | Declaration of |
| Correspondence | Independence |

- | | |
|---------------------|--------------------|
| Flag | Paris, Treaties of |
| Great Britain | Stamp Act |
| Liberty Bell | United States of |
| Minutemen | America |
| Navigation Acts | Valley Forge |
| Writs of Assistance | |

BATTLES

- | | |
|-------------------|-------------|
| Bon Homme Richard | Princeton |
| Bunker Hill | Saratoga |
| Concord | Ticonderoga |
| Lexington | Trenton |

BIOGRAPHY

- | | |
|----------------------|------------------------|
| Adams, Samuel | Jones, John Paul |
| Allen, Ethan | Lafayette, Marie J. P. |
| André, John | Lee, Charles |
| Arnold, Benedict | Lee, Henry |
| Clark, George Rogers | Lee, Richard Henry |
| Cornwallis, Charles | Marion, Francis |
| De Kalb, Johann | North, Frederick |
| Franklin, Benjamin | Otis, James |
| Gage, Thomas | Putnam, Israel |
| Gates, Horatio | Revere, Paul |
| Greene, Nathanael | Ross, Betsy |
| Hale, Nathan | Steuben, Baron von |
| Hancock, John | Washington, George |
| Howe, William | Wayne, Anthony |

THE VICTORY AT YORKTOWN

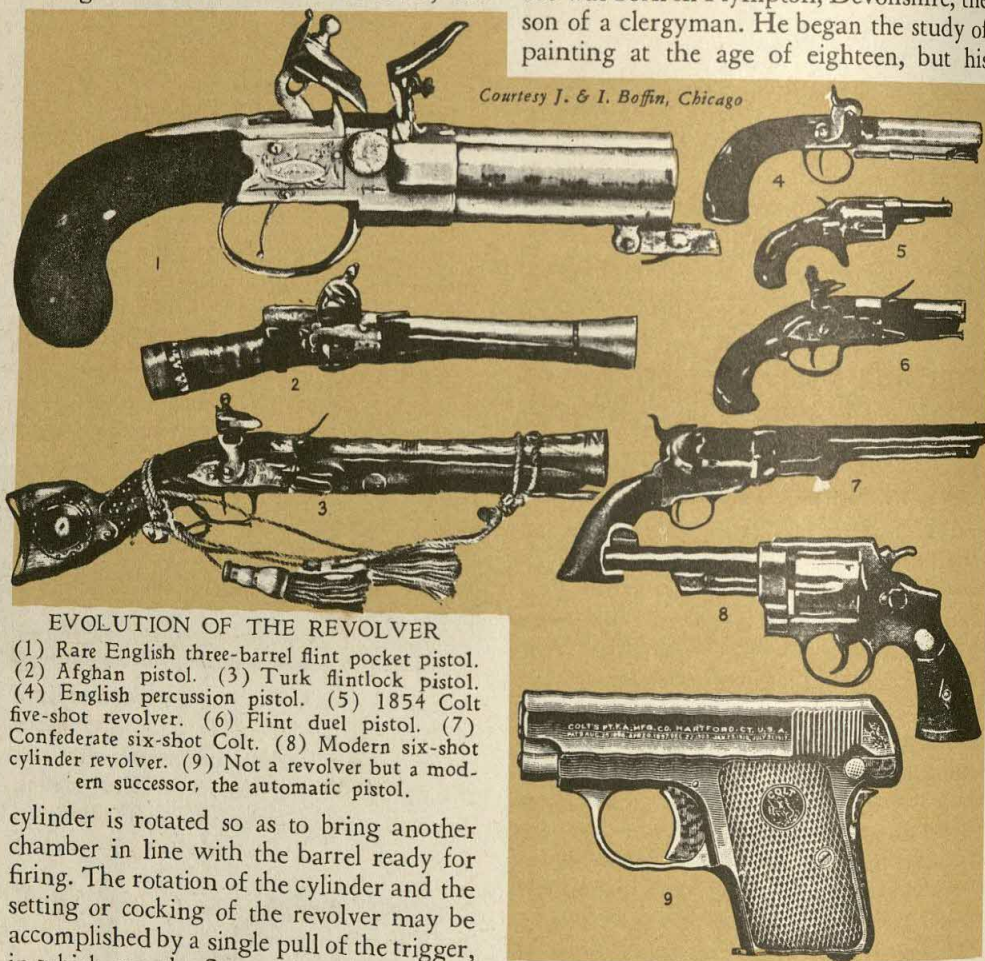
The trapping of Cornwallis is diagramed on this map. The movement of British troops and ships is indicated by the broken white lines and arrows, while the solid black lines and arrows represent the encircling tactics of the American and French land and sea forces.



REVOL'VER. Named for its rotating cylinder which has a number of chambers into which cartridges are inserted, the revolver is a pistol with a short barrel and a grip modeled to fit one hand. When a cartridge is discharged from one chamber through the barrel of the revolver, the

REYNOLDS, ren'uldz, JOSHUA, Sir (1723-1792). One of England's greatest masters of portraiture, Joshua Reynolds painted the likenesses of so many notable figures that his canvases are a valuable contribution to the recorded history of his time. He was born in Plympton, Devonshire, the son of a clergyman. He began the study of painting at the age of eighteen, but his

Courtesy J. & I. Boffin, Chicago



EVOLUTION OF THE REVOLVER

- (1) Rare English three-barrel flint pocket pistol.
- (2) Afghan pistol. (3) Turk flintlock pistol.
- (4) English percussion pistol. (5) 1854 Colt five-shot revolver. (6) Flint duel pistol. (7) Confederate six-shot Colt. (8) Modern six-shot cylinder revolver. (9) Not a revolver but a modern successor, the automatic pistol.

cylinder is rotated so as to bring another chamber in line with the barrel ready for firing. The rotation of the cylinder and the setting or cocking of the revolver may be accomplished by a single pull of the trigger, in which case the firearm is said to be *self-cocking*. The cylinders are usually made to carry from five to seven cartridges. In the more modern firearm, the barrel is hinged, and provision is made for the quick ejection of all empty cartridges and reloading.

The earliest practical revolver was invented by Samuel Colt in 1835. The weapon was much used by horsemen on the Great Plains and was referred to as "civilizer of the West."

best opportunity for advancement came during a visit to Italy (1749-1752). This three-year period of study was made possible by his friend, Admiral Keppel, who not only took him to Italy but introduced him to wealthy and friendly art patrons on his return to London.

Reynolds painted the portraits of such literary men as Johnson, Burke, Goldsmith, and Sheridan, and these writers were among the celebrities who joined the



The Louvre

MASTER OF PORTRAITS

Reynolds' style, above, was popular with social and stage beauties. Self-portrait at right.



National Portrait Gallery

famous Literary Club, founded by the artist in 1764. Beauties of the stage and society also sat to him. In 1768, when the Royal Academy was founded, Reynolds became its first president. The next year he was knighted. His discourses on painting, delivered annually before the Academy, were published in book form.

Reynolds was not a master of drawing, but he was a great colorist and his portraits are remarkable likenesses. Probably the most famous is *Mrs. Siddons as the Tragic Muse*, now in the Huntington collection in San Marino, Calif. The great art galleries of America and England possess examples of his work.

RHEA, re'ah, or NAN'DU. Living in flocks on the plains of Southern Brazil, Uruguay, Paraguay, and Northern Argentina, the rhea is so ostrich-like in appearance that it has often been called "the South American ostrich." There are, however, a number of important differences between the two birds. Rheas are but half as large as ostriches and their necks and

heads are feathered, while those of the ostrich family are bare. The rhea also differs from the ostrich in having three-toed clawed feet, while those of the ostrich are two-toed and clawless. Neither bird has wings large enough to permit flying.

In the rhea community, there are usually two or more hens and a male in each family. The hens of each group lay their eggs in one nest, and when there are about two dozen in the nest, they are hatched by the male. Unlike the habits of most fowl, the young are fed and protected by the male bird until they are old enough to shift for themselves.

RHEA. Greek mythologists often referred to Rhea as "Mother of the Gods" or "Great Mother." She was supposed to have been the daughter of Uranus and Gaea (Heaven and Earth), the wife and sister of Cronus, and the mother of Zeus, Hades, Poseidon, Hera, Hestia, and Demeter. Rhea symbolizes the reproductive power of Nature.

RHINE, rine. To the German people the Rhine River is the very soul of their culture and industry. Their patriotic song, *Die Wacht am Rhein*, is dedicated to this great stream, and the Lorelei and Nibelung legends are associated with it. The Rhine flows through regions of historic interest, mineral and agricultural wealth, and scenic beauty.

About 800 miles in length, it rises in the Saint Gotthard Pass in Switzerland. It flows northeast to Lake Constance, cuts sharply west to Basel, then again flows



ONE OF THE LARGEST LAND MAMMALS

The massive rhinoceros takes its name from the Greek for "nose horn."

northward. From Basel to the mouth of the stream, a distance of some 550 miles, the Rhine is navigable and forms an important outlet for the timber, coal, farm produce, and iron of Southern Germany. As it flows slowly northward, it cuts through high, rocky banks and forested slopes, the crests of which are dotted with romantic, vine-covered castles of the medieval robber barons.

Along its course lie many important cities, including Mannheim, Mainz, Coblenz, Cologne, and Düsseldorf in Germany, Basel and Constance in Switzerland, and Arnheim, Utrecht, and Leiden in Holland. Near its mouth, like the Mississippi below New Orleans, the Rhine splits into many branches and forms numerous deltas as it enters the North Sea. Throughout its length, the Rhine abounds in fish, principally whitefish, carp, and pike. See **GERMANY**.

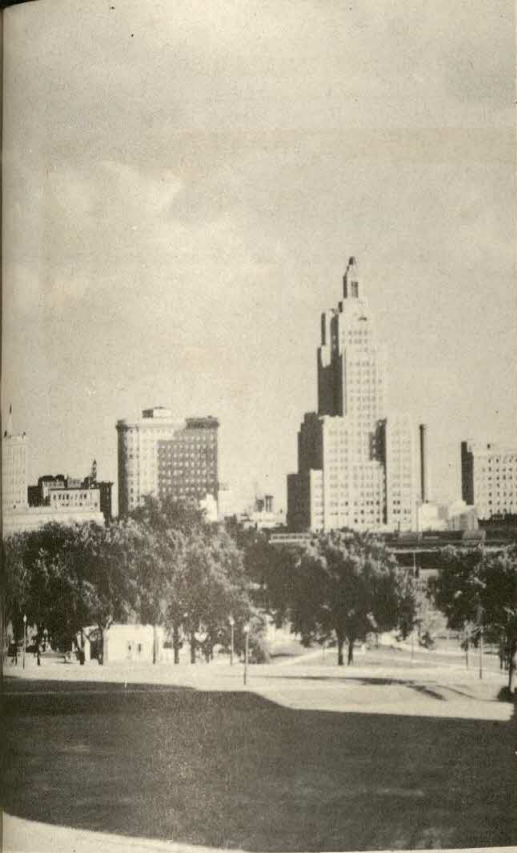
RHINOCEROS, *ry nos'ur os*. Only two animals living on the land, the elephant and the hippopotamus, are larger than the rhinoceros, and the hippopotamus is but slightly larger. The rhinoceros differs from either of these animals in that it possesses one or more horns on its head. They are

unlike the tusks of elephants, as they are on the top of the snout and are not connected directly with the skull. A rhinoceros may be fourteen feet from the tip of the nose to the tip of the tail and stand six feet at the shoulder, but animals of this size are not common.

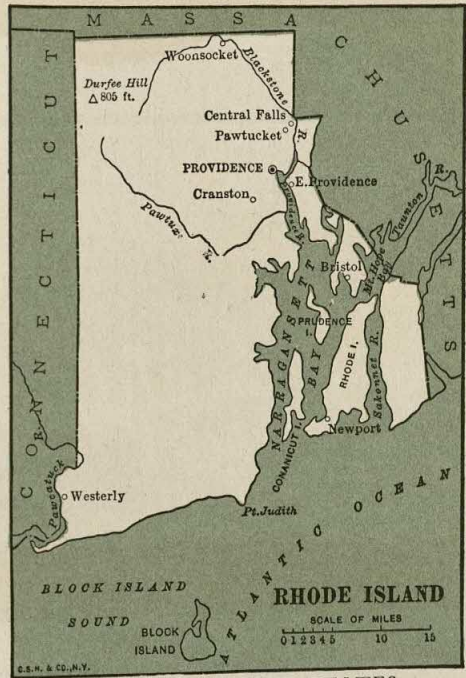
Rhinoceroses are usually quiet animals which like to be left alone. If forced to fight they are terrible creatures, as they can run nearly as rapidly as horses, and their great weight makes it difficult to stop them.

Rhinoceroses live entirely upon plant materials. They are commonly active only at night and then may be found feeding in marshy places or dry fields. The animals are hunted for their hides, which are very thick and tough. Their flesh, particularly that of young animals, is eaten. While there is plenty of proof that the rhinoceroses formerly lived in North America, at present they are found wild only in Asia and Africa. There are a number of species, among these being the *African* rhinoceros, a two-horned species with close-fitting skin; the *Indian* rhinoceros, a one-horned form with skin in folds; and the *white*, or *square-mouthed*, rhinoceros, one of the largest types, now nearly extinct.

RHODE ISLAND



Information Division, Rhode Island Development Council



SMALLEST OF THE STATES

Left, a view of Providence, the capital of Rhode Island. Above, the entire "State of Rhode Island and Providence Plantations."

RHODE ISLAND. Abundant water power and thriving factories have made "Little Rhody" one of the important states of the Union. It is, nevertheless, the smallest of the states, with an area of only 1,214 square miles. It has played an important part in the history of the United States, for it was one of the original thirteen colonies. It has long been known for its progressive and liberal ideas, for Roger Williams founded a colony there devoted to democratic government and freedom of religion.

Rhode Island is bounded on the north and east by Massachusetts, on the south by the Atlantic Ocean, and on the west by Connecticut.

Features of the Land. The surface of Rhode Island is generally hilly, but not mountainous. Much of the state was once a mountain range which was worn down ages ago by glacial action.

Narragansett Bay, with its north arm formed by the Providence River, cuts into the mainland for about twenty-eight miles,

giving the state a coast line of about 350 miles, although the Atlantic coast is only forty-five miles long. Most of the state slopes toward the south, where at the coast the land in some places is low and swampy. The shore becomes higher to the east, sometimes forming rocky cliffs.

The principal rivers of the state are the Pawcatuck, the Blackstone, and the Pawtuxet. All the rivers are short, but they furnish valuable water power.

Climate. Rhode Island has a typical New England climate, with cold winters and cool summers. The climate is, however, moderated somewhat by Narragansett Bay. The average temperature is about 48°F. Rainfall averages about fifty inches a year.

Products of the Land. There are only a few minerals available in Rhode Island. Coal deposits lie in the eastern part of the state. Granite is quarried in several places, particularly in the southwestern sections. There are also some deposits of iron, graphite, limestone, and clay.



A SUMMER DAY IN RHODE ISLAND WATERS

R. I. Secretary of State

Sailboats race in a spanking breeze in one of the many inlets of Narragansett Bay.

Rhode Island is not one of the great agricultural states, due to the clayey soil. The best farming regions are in the northwest and on the island of Rhode Island in Narragansett Bay. Crops produced include potatoes, hay, corn, oats, and rye. Market gardening and the growing of fruits and nursery stocks are important. The Rhode Island Red chicken was developed here, and the raising of poultry is a leading farming pursuit, as is dairying. The Narragansett pacer, a fine saddle horse, and the Rhode Island greening apple also were developed here.

Manufactures. Rhode Island's chief in-

dustry is manufacturing. It not only bleaches, prints, and dyes textiles, but also makes cotton, woolen, silk, rayon, nylon, knitted, and other kinds of goods. The state is a top producer of jewelry, silverware, machinery and tools, glass, and plastics. Other industries include fishing, boat building, publishing, printing, and the manufacture of electrical and optical supplies, rubber goods, and other products.

Transportation. Rhode Island has an excellent highway system and fine rail and air service as well. Water transportation is afforded by Narragansett Bay and the

ocean, linking the state with New York.

The People and Their Institutions.

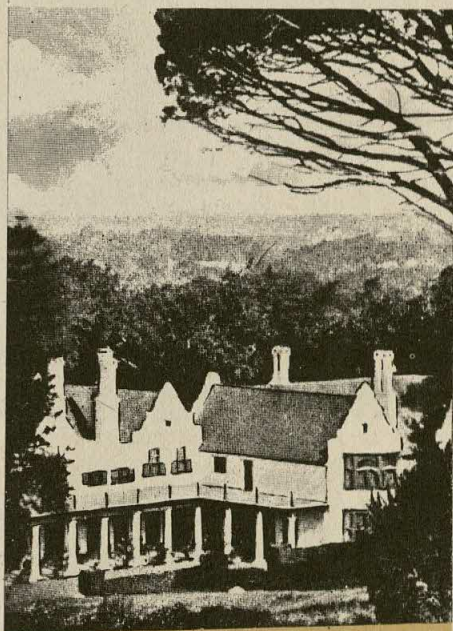
Rhode Island is the most thickly populated state in the Union. With a population of 853,000, it has an average of about 703 people to the square mile. There is a large foreign-born group which makes up about one fourth of the population. The largest city and the capital of the state is Providence; it is followed by Pawtucket, Woonsocket, and Cranston. More than ninety per cent of the people live in urban districts.

The governor of Rhode Island is elected for a two-year term. The legislative branch of the government consists of a two-house legislature. The senate is composed of forty-two members and the house of representatives of 100 members. At the head of the judiciary is a supreme court, whose members are elected by the legislature.

In addition to a state system of education, that is noted for its progressive and liberal policies, there are several institutions of higher learning, among which are Providence College, the Rhode Island College of Education, Brown University, and the Rhode Island State College.

History. The first settlement of Rhode Island was made by Roger Williams in 1636. He settled on the site of the present city of Providence. Other settlements soon sprang up at Portsmouth, Newport, and Warwick. These were governed under a liberal charter, which was replaced by another in 1663. Under the latter the colony was governed for 180 years. The colony's principles of religious freedom drew many people to it. Desire for freedom caused Rhode Island to be one of the first to throw off the English yoke; it was, however, the last to sign the Constitution.

By the turn of the nineteenth century, the state had become a leading industrial center. Its increasing progress and prosperity languished for a time in 1842, when a rebellion broke out because of the lack of representative government. In that year, however, the constitution was revised. See PROVIDENCE; WILLIAMS, ROGER.



Courtesy-Raymond-Whitcomb, Inc.

THE "GREAT GRANARY"

At the foot of Table Mountain is Groote Schuur, once the country estate of Cecil Rhodes.

RHODES, rohds. Once the center of Greek culture, the island of Rhodes is the most famous of the Dodecanese group, comprising thirteen islands in the Aegean Sea. It has an area of about 542 square miles, and its surface is broken by mountains which are separated by well-watered valleys. Here the fertile soil and mild climate aid in producing large crops of fruits, grains, and tobacco. In ancient times, its chief city, Rhodes, was noted as a center of learning, and for the great statue, the *Colossus of Rhodes*, astride the harbor. The Romans controlled the island for many years, and the Byzantine Empire held it until 1309, when it was taken by the Knights Hospitalers. Two hundred years later, it was lost to Turkey, and in 1912 it was seized by the Italians. The population is about 62,000.

RHODES, CECIL JOHN (1853-1902). Thousands of square miles of territory in Africa are British because of Cecil Rhodes, the "empire builder." Born in England, Rhodes went to South Africa for his health



Northern Rhodesia Information Dept.

PREPARING FOR A LONG, WARM WINTER
Natives of Northern Rhodesia store their grain in thatched huts built on stilts.

when he was seventeen years old and, within two years, amassed a fortune from diamond mines in the Kimberley fields. After a trip deep into the interior of the Dark Continent, Rhodes returned to England where, at Oxford University, he dreamed of adding to the British Empire the lands he had seen. While he was still a student, he returned to Africa several times.

In 1881 he was elected to the assembly of Cape Colony, and in a short time set out to fulfill his dream. Bechuanaland was the start, becoming annexed in 1884 and four years later he negotiated for rights in the huge territory now known as Rhodesia. Becoming prime minister of Cape Colony in 1890, he laid the plans for the Cape-to-Cairo Railway, but his dreams of empire brought on a war with the Boers who had settled in the Transvaal.

He resigned as the head of the government, went to Kimberley, and aided in the battle, but he did not live to see the treaty of peace signed, which gave Great Britain even more land in Africa. Rhodes laid the groundwork for the present Union of South Africa, formed in 1909. His will provided for Oxford scholarships. See CAPE-TO-CAIRO RAILWAY; RHODESIA; RHODES SCHOLARSHIPS.

RHODESIA AND NYASALAND, *roh-de' zhi a, nyah' sah*. These two British territories in south-central Africa are joined in a federation. Its estimated population is about 7,650,000, and its area about 490,000 square miles.

The federation was proclaimed on August 1, 1953, when an Order-in-Council to that effect was signed by Queen Elizabeth. The Queen's Order had been authorized by the British Parliament after much study of the problems of the two territories. Combination had been thought of before World War II but it had proved possible to do little before 1945.

Rhodesia is named for Cecil Rhodes and is divided into Northern and Southern sections by the Zambesi River and Victoria Falls. Northern Rhodesia is made up mostly of jungles. It does have grasslands, however, which offer a pleasant climate. Southern Rhodesia is smaller but better developed. It has more European residents and, like the Northern section, experienced a boom after World War II.

Sleeping sickness and malaria long discouraged conquest of the Rhodesian wilderness by Europeans. Penetration was made only gradually and it was not until the 1920's that the territory was organized as two full-fledged British colonies.

Under the 1953 Order-in-Council, Southern Rhodesia remains the self-governing colony which it has always been while Northern Rhodesia and Nyasaland are British protectorates. For years, the Rhodesias had been governed by a privately-owned concern, Cecil Rhodes' British South Africa Company.

The federation has a future task of meeting the challenge presented by the great need for understanding between the races. In 1956, skilled positions in the copper industry were opened to African inhabitants of the territory but there was much labor trouble. A university college where race was not a requirement for entrance was opened at the federation capital of Salisbury, in March, 1957.

The federation is important as a source of minerals—copper in Northern Rhodesia—and is now undertaking many construction projects. These include the linking of the country's railways with those of Portuguese East Africa and advances in hydroelectric power. Gold has been mined since

RHODES SCHOLARSHIPS

ancient times. Other important minerals include asbestos and chromite.

Rhodesia's chief export is tobacco. Other crops include corn, citrus fruits, wheat, and coffee. Cattle ranching, also important, provides hides for export. Industries include engineering, the building trades, and the manufacture of iron, steel, clothing, enamelware, jute products, and cement. The colony has airlines, highways, and river transport. Its railways are government-owned and were planned to be part of the Cape-to-Cairo system.

In addition to copper, Northern Rhodesia has valuable supplies of lead, zinc, cobalt, manganese, vanadium, and uranium. Its extensive forests provide fine timbers, the most important being Rhodesian teak.

Nyasaland is primarily an agricultural territory. It has a high percentage of Africans in its population and can furnish a large supply of native labor to the growing industries of Rhodesia. Tea and tung oil are its main products though it also raises cotton, soybeans, and tobacco.

The federation extends southward from Tanganyika and the Belgian Congo to the Union of South Africa. Angola and South-West Africa are to the west. Mozambique is to the east. Northern Rhodesia contains part of the Congo basin.

For further information, see the following:

Cape-to-Cairo Railway	Rhodes, Cecil John
Congo River	Victoria Falls
Livingstone, David	Zambesi

RHODES SCHOLARSHIPS. Established by Cecil Rhodes' will, these scholarships are intended to strengthen British-Empire ties and to promote international good will. Each year, from 180 to 200 scholarships are divided among the United States and certain members of the British Commonwealth, making it possible for the winners to live and study at Oxford, or, in some cases, at another approved university.

Canada, Australia, and the Union of South Africa each receives one scholarship for each of its provinces or states.



U.S.D.A. Photograph

ORNAMENTAL EVERGREEN

This laurel species of rhododendron grows in the Pisgah National Forest, North Carolina.

Other Commonwealth areas getting awards include Rhodesia, New Zealand, India, Pakistan, Malta, Jamaica, and Bermuda.

In the United States competitions are held annually in each state, and successful candidates must then appear before the committee of one of the eight districts into which the nation is divided. Each committee awards four scholarships, giving the United States a total of thirty-two. A candidate must be a male citizen, unmarried, and between nineteen and twenty-five years old. He must also have completed two years of study in a recognized American college or university. See RHODES, CECIL JOHN.

RHODODENDRON, *roh doh den'dron*. Some of the most showy flowering shrubs and trees belong to this genus of the heath family, whose name means *rose tree*. Various species thrive in the Eastern United States, the Pacific Coast region, India, and the Himalayas. The *coast rhododendron* is the state flower of Washington; the popular *great rhododendron*, *great laurel*, or *rose bay*, that of West Virginia. The latter might very well be the

most important broad-leaved evergreen in the garden if it could be grown over a wider range of territory in North America. Though it ranges from Eastern Canada to Georgia, it will not thrive on limestone soil nor where exposed to drying winds or hot sun. It is most at home in partial shade along the margins of woods in moist, more or less acid, soil. In the Allegheny Mountains the shrub grows wild in such profusion that it forms impassable thickets.

It is a most attractive plant, with broad, dark-green, glossy leaves, and spectacular flowers in large, terminal clusters. There are many varieties in white and all shades of pink, red, and purple.

RHONE, *rohn*. Commercially important to France is the Rhone River, whose waters teem with barges and freight boats, carrying grain and other products of the rich region through which it flows. The river, 504 miles long, rises in the Rhone glacier of the Swiss Alps, and flows westward through Lake Geneva. After entering France it turns southward, passing to the south of the Jura Mountains. After leaving the city of Lyon it is joined by several large tributaries, which together form a long, navigable stream to the sea.

The Rhone, with its tributaries, the Saône, Durance, and Isère, drains the whole southeastern section of France. Its commercial value has been greatly enhanced by a system of canals that connect with the Rhine, Seine, Loire, and Moselle rivers. The Rhone has been a factor in settlement, conquest, and commerce since before the time of the Romans.

RHUBARB, *roo'barb*. Widely grown throughout temperate regions, the rhubarb, or pieplant, is a perennial plant believed to have originated in China or Siberia. The rhubarb has fleshy roots, large, juicy, pinkish stalks, and broad, green leaves. It usually grows about two feet high. The stalk is the edible portion of the plant and is made into pies, sauce, or wine. It is marketed fresh or canned. Rhubarb has laxative and tonic qualities and is especially valuable when fresh fruits are not available.

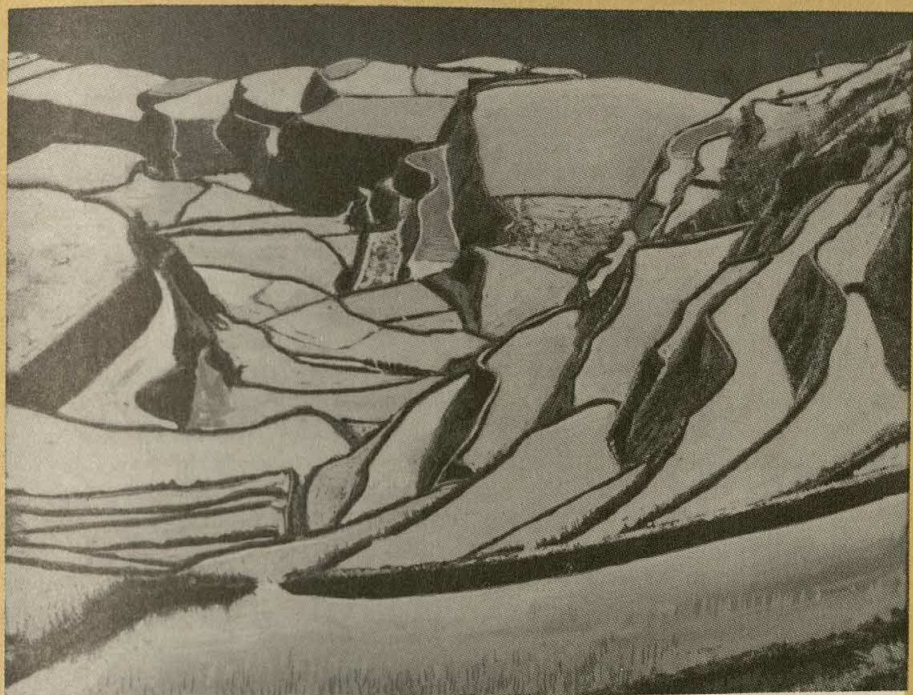
RIBBONFISH. Like a broad, silver band floating through the deep, the ribbonfish is one of the most peculiar of deep-sea creatures. It is found in all seas and may be from fifteen to twenty feet long, about a foot wide, and from one to two inches thick. Like the bodies of all animals that inhabit the ocean depths, the body of the ribbonfish is partially filled with air for protection against the tremendous pressure of the water. Consequently, when one is caught and raised to the surface, it dies quickly. Seldom has a perfect specimen been obtained.

The name is also applied to a thin, but not ribbon-shaped, fish of the Gulf of Mexico. This specimen is grayish in color, and marked with blackish-brown streaks.

RIBS. The walls of the chest are formed chiefly by narrow, flattened, and curved bones, the ribs. There are twelve pairs of ribs, of which the upper seven pairs articulate directly with the breastbone; the eighth, ninth, and tenth pairs do not thus articulate, but join the cartilage of the seventh rib; the eleventh and twelfth pairs have no front support and are designated as *floating* ribs. All the ribs articulate with the spinal column. The shape and articulations of the ribs are such that when they are raised, as in breathing, the capacity of the chest is increased.

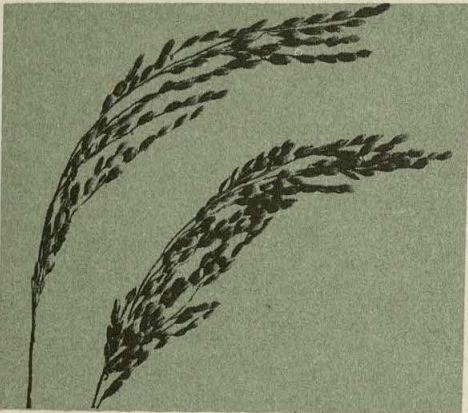
RICE. If all the rice in the world were to be suddenly destroyed, half of the earth's population would be faced with starvation. For this member of the grass family forms the principal food of the millions of people living in China, Japan, India, and many of the smaller Oriental countries. It is an ancient crop and was raised in the East for many centuries before being cultivated in Greece and Rome. The total annual rice crop of the world is estimated at 100 billion pounds. Most of this crop is grown in the Orient, particularly in China, where two crops a year are common. The American crop of more than 50,000,000 bushels is produced chiefly in Louisiana, Texas, Arkansas, and California.

Rice is similar in appearance to oats and



LIFE GRAIN OF THE ORIENT

Rice is the principal grain crop of the tropical countries of Eastern and South-eastern Asia, where it is used daily in large quantities as the principal food. Top, where land is scarce the crop is grown in walled terraces. Below, left, a Japanese woman separating rice from straw. Right, Burmese women pounding and sifting rice.



MUCH LIKE OATS

Rice seeds are borne in panicles on the stems.

barley, but it requires a larger amount of moisture for growth. The plants usually reach a height of two to six feet, bearing the seed in small, separate stalks springing from the main stalk. Like all other grasses, rice has a round, jointed stem.

The seed is sown in a well-pulverized seed bed, and as soon as the plants are about eight inches high, the land is flooded with water. The field is drained when the plant matures, and the crop is cut and thrashed like wheat. As the thrashed grain comes from the separator, it is enclosed in a brown hull which must be removed by milling machinery. In the Orient, cutting is done by sickle, and thrashing and hulling by animals and flails. In the United States, the rice is graded, polished, and coated with talc or glucose. The broken grains are sold as an inferior grade.

Sixty-eight per cent of the rice kernel is starch, and in some localities in the Southern states, rice is served daily instead of potatoes at dinner. It is sometimes regarded as a breakfast cereal, but is more often served as a dessert or as a substitute for meat and vegetables. Favorite dishes include rice puddings; rice cooked with cheese, with leftover meat, and with fish; rice seasoned with tomatoes, onions, and other seasonings; and a combination of boiled rice and chop suey. Combining rice with fat and protein foods gives a better balance. The unpolished kernels contain

a valuable vitamin. Where the diet is varied, the use of the polished grain is not harmful, but in the Orient the disease beriberi is common among people who live chiefly on polished rice.

The bran of rice (seed coats and embryo) and the fine flour derived from polishing are used as food for cattle and swine. Rice starch is employed for laundering, sizing paper and cotton goods, and for thickening colors used in textile printing. The Chinese and Japanese use rice straw for hats, and a Japanese drink, *sake*, is made from fermented rice grains.

RICHARD I (1157-1199). When Robin Hood and his merry men roamed Sherwood Forest, Richard the Lion-Hearted was king of England. But Richard, more concerned with war and battles than with the problems of state, spent much of his time crusading in the ten years of his reign.

As the third son of Henry II, Richard was not originally entitled to the throne, but he waged war against his father and, with the aid of the king of France, defeated him in 1189. That year, Henry died, and Richard was crowned king, since his elder brothers had died.

The ten years of Richard's reign were unmarked by any constructive legislation. Richard visited his kingdom occasionally, but left the government mainly in the hands of his brother John and Hubert Walter. John was guilty of many harsh measures, but Richard forgave him. The reign, however, was one of heavy taxation so that Richard could carry on his wars, and the people grumbled considerably.

Returning from the Third Crusade, Richard was shipwrecked; and when he crossed Europe, he was captured by Duke Leopold of Austria and was imprisoned. While the king was being held for ransom, it is said that his faithful minstrel, Blondel, with whom Richard had written a number of ballads, found him, returned to England, and arranged for the payment of the ransom and his release. Richard returned to England in 1194. Crossing to France, he



A CRUSADING KING OF ENGLAND

Richard Coeur de Lion played a prominent part in the Third Crusade, his military ability helping in the capture of the Acre stronghold.

built the Chateau Gaillard on the Seine to protect his French possessions.

In 1199 he engaged in a minor battle with the French at Limoges, and there was struck in the shoulder by an arrow from a crossbow. The wound resulted in his death. Historians regard Richard as a brave and dashing warrior, a versatile and talented musician, and a generous and warm-hearted man. But he is not considered a particularly wise ruler. See CRUSADES; ENGLAND.

RICHARD II (1367-1400). Weak in character, Richard II came to the throne

of England when strength was required to hold the crown. Although he ruled for twenty-two years, he died a comparatively young man, and without the royal title.

Richard was the son of Edward, the Black Prince, who died in 1376. A year later, Edward III, his grandfather, died, and Richard, only ten years old, became king. Trouble began almost immediately. The impoverished condition of the kingdom and the high taxes caused a peasant's rebellion in 1381, led by Wat Tyler and John Ball. Richard, a youth of fourteen, promised reform, but broke his promise as soon as violence was averted.

Following a period of war and internal disturbances, he banished his cousin, the Duke of Hereford, in 1396. Seizing Hereford's inheritance, he left for Ireland, but upon his return, in 1399, found Hereford was leading a revolt against him. Richard's army deserted him, and he was forced by Parliament to abdicate his throne. Hereford, also called Bolingbroke and Duke of Lancaster, then was crowned king as Henry IV. Richard was imprisoned and was probably murdered, in February, 1400. See ENGLAND.

RICHARD III (1452-1485). The brazen seizure of the English throne by Richard, son of the Duke of York, is familiar to all readers of Shakespeare's great play, *Richard III*. As Duke of Gloucester, Richard was the regent for his nephew, King Edward V, before the latter was old enough to rule. But Richard imprisoned the young monarch and his brother, and had himself declared king in 1483, as Richard III. The princes later were murdered, probably on Richard's orders. The Duke of Buckingham and his followers opposed Richard, and, joined by the Earl of Richmond, overthrew him at Bosworth Field in 1485. Richard was killed in the battle, and Richmond became king as Henry VII. See ROSES, WARS OF THE.

RICHELIEU, *re shuh lyu'*, ARMAND JEAN DU PLESSIS, Duc de (1585-1642). No royal crown adorned the head of Cardinal Richelieu, yet he was the virtual ruler of



A CONCERT AT THE PALACE OF THE CARDINAL

Cardinal Richelieu was not only a shrewd and commanding statesman, an able military leader, and a far-seeing administrator, he was a patron of the arts and letters. He gathered the keenest minds of France about him and supported a court as pretentious as that of Louis XIII.

France from 1624 until his death.

Richelieu came of a noble Parisian family and originally intended to join the army. Instead, however, Henry IV nominated him Bishop of Luçon in 1606. In 1614 he became a delegate of the clergy to the States-General, the national assembly. There he won the favor of Maria de' Medici, mother of the boy king, Louis XIII, and became grand almoner. Louis had succeeded Henry in 1610. In 1616 Richelieu won the post of Secretary of State for War and Foreign Affairs, but in 1617 he was banished because of a quarrel between Louis and his mother. Richelieu, however, won his way back to favor a few years later when he reconciled the two. In 1622 he was made a cardinal, and two years later he became Louis' chief minister.

Richelieu halted the rise of the Huguenots as a political power, checked the desires of ambitious nobles, undermined the power of the Hapsburgs, and put France in the strongest position the nation had ever

enjoyed in world affairs. In addition, he founded the famed French Academy, which endures today.

RICHMOND, VA. Above the James River on a series of low hills is the city of Richmond, capital of Virginia, county seat of Henrico County, and once the leading center of the South, home of many famous men. It was the capital of the Confederate States during the Civil War and the main point of attack by the Union forces. Its population is about 220,000.

Dominating the main part of the city is Capitol Square, which contains the capitol building, constructed from plans secured by Thomas Jefferson and completed in 1789. Other famous buildings in the square are Saint Paul's Church, the state library, and the governor's mansion. Other well-known historical buildings are the house of Jefferson Davis, at present occupied by the Confederate Memorial Society, the Virginia State Library, the Valentine Museum, and the headquarters of the Virginia His-

torical Society, where Lee once lived.

Parks and Monuments. Richmond has nearly 1,000 acres of land devoted to parks and playgrounds, and many of these contain monuments of famous men. Capitol Square, at the heart of the city, contains an equestrian statue of George Washington, regarded as one of the finest in the United States. Lee Circle contains monuments to the Southern heroes of the Civil War. In various parts of the city are several beautiful cemeteries, where many Union and Confederate soldiers are buried. Other parks include William Byrd, Libby, and Bryan.

Institutions. The people of Richmond are proud of their modern municipal swimming pool and auditorium. There are also several institutions of higher learning in the city, including the University of Richmond, Union Theological Seminary, and branches of the University of Virginia and William and Mary College, as well as a number of public and private schools, libraries, and charitable institutions.

Trade and Industry. The chief industry of Richmond is the manufacture of tobacco products. The city is one of the leading tobacco markets in the country. The industrial development of the city has been greatly stimulated by the abundant water power furnished by the James River. In addition to tobacco manufacturing, the city has such industries as papermaking, printing, binding, iron and steel manufacturing, engraving, flour milling, and the production of lumber products and machinery.

History. Richmond was founded by Colonel William Evelyn Byrd in 1733. It was incorporated as a town in 1742 and was chosen as the capital of Virginia in 1779. It was chartered as a city three years later. Richmond was rebuilt after the devastation of the Civil War, and entered a period of progress and prosperity. See CIVIL WAR IN AMERICA.

RIEL, LOUIS (1844-1885). The worst rebellion in Canadian history was started by Louis Riel, a half-breed who lived in the West. He was born at Saint Boniface,

Man., and in the 1860's he worked at odd jobs in Minnesota. Then, in 1869, the territorial rights of the Hudson's Bay Company were transferred to the British government and then to the Dominion of Canada, and Riel led a group of angry half-breeds in armed revolt. The rising was called the Red River Rebellion (see RED RIVER REBELLION). When an expeditionary force was sent against the rebels, Riel escaped to the United States.

Several years later, Riel was elected to the House of Commons, but his colleagues soon ousted him. He was elected again a short time later, however, but was outlawed permanently in 1875. After spending several years in Montana, Riel was called to Saskatchewan by his countrymen, and again trouble began. Another rising, the Saskatchewan Rebellion, occurred. This time Riel was captured and convicted of treason, and in November, 1885, he was hanged. See SASKATCHEWAN REBELLION.

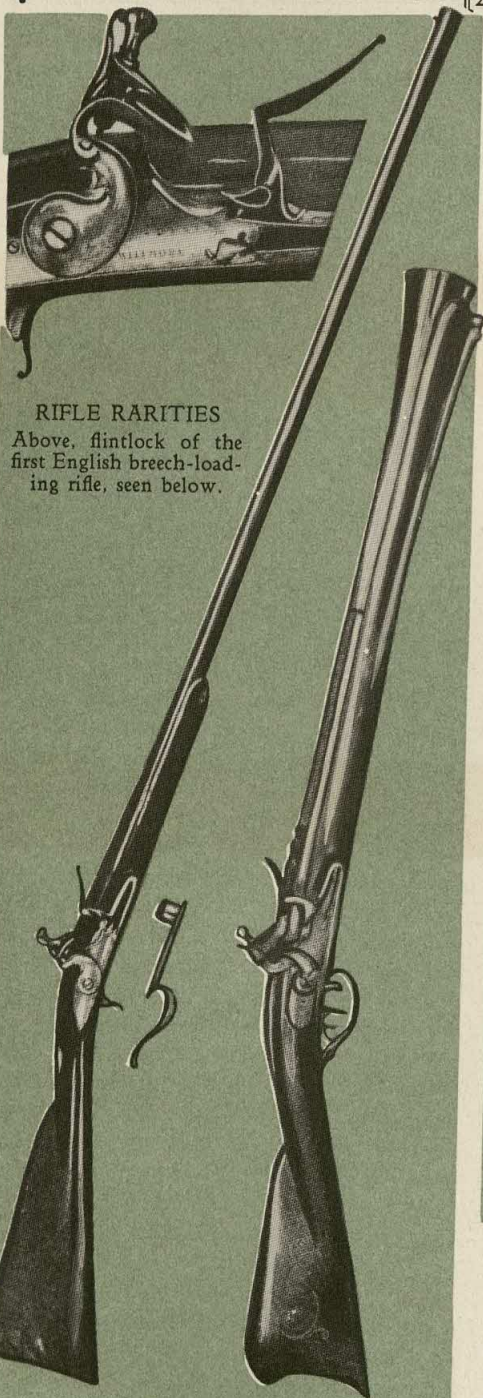
RIFLE, *ri' fl*. Settlement of America east of the Mississippi River was materially aided by the rifle, a firearm that traces its origin back to the fifteenth century. It was this weapon that enabled the woodsman to defend himself against the deadly, accurately fired arrows of the Indians, and to kill the game necessary for his food and clothing.

There are records showing that the rifle was used as early as 1476 in Germany, but authorities are not sure when the principle of the rifle—grooving of the bore to give the bullet a whirling, rotary motion in flight—was invented. In the Revolutionary War the rifle was used by some of the settlers, but the common weapon was the old smooth-bore musket.

Modern military rifles weigh on an average of nine pounds without bayonet. They are breechloaders, possessing bolt systems, and have magazines which carry five to ten rounds of ammunition. The bores range between .256 and .315 inch.

The rifles in use in the United States Army have .30-inch bores and fire conical, or "streamlined," bullets at a speed of

[2922]



RIFLE RARITIES

Above, flintlock of the first English breech-loading rifle, seen below.

ARMS COLLECTION PIECES

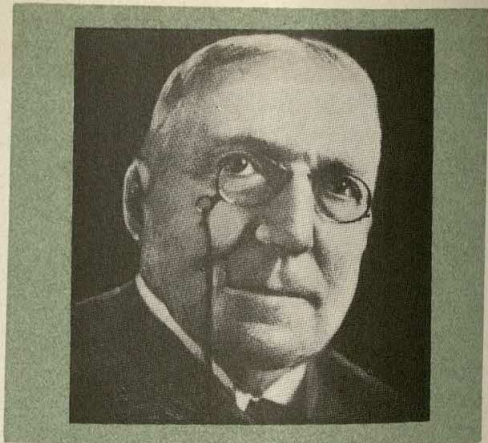
The graceful and beautifully finished weapon at the left is the first breech-loading rifle of English make. Right, early French gun.

more than 2,000 feet per second. Until 1939 the Springfield rifle, with a manually operated bolt, was the standard rifle. The Garand, released to troops in 1939, has an automatic bolt system.

Fully automatic guns fire several shots with one pull of the trigger. The power of the explosion extracts and ejects the spent cartridge automatically. During the Second World War, automatic rifles were widely used.

Sporting rifles are usually light, and of a modified type, employing bores of .22 to .60 inch. The type of bullets varies according to the game sought.

The rifle bullet, differing from the round ball used in ancient muskets, is an elongated, cone-shaped projectile the sides of which are made to fit the rifling of the bore. They are made usually of cupro-nickel (copper and nickel) and capped with a nickel or hard steel point. The trajectory of a rifle bullet is almost flat, owing to the rotary motion of the spiral grooves in the bore. See BULLET.



BELOVED HOOSIER POET

James Whitcomb Riley, interpreter of Indiana.

RILEY, JAMES WHITCOMB (1849-1916).

High in the list of Indiana's famous writers is the name of James Whitcomb Riley, the "Hoosier poet." A native of Greenfield, Ind., he received only a grade-school education and later joined a patent-medicine troupe rather than study law in his father's

office. When he was twenty, he began contributing verses to newspapers under the name of Benjamin F. Johnson, of Boone.

Riley's best-known verses, written in Hoosier dialect, are witty and full of homely philosophy and reveal an understanding of human nature. Some of the

best-known volumes include: *The Old Swimmin' Hole* and *'Leven More Poems, Afterwhiles, A Child World, Rhymes of Childhood, Character Sketches and Poems, Green Fields and Running Brooks, An Old Sweetheart of Mine, and Book of Joyous Children.*



Moore-McCormack Lines, Inc.

FRONT YARD OF ROMANTIC RIO DE JANEIRO

Copacabana Beach and Sugar Loaf Mountain are the delight of tourists from many lands.

RIO DE JANEIRO, *re'o day zha na'ro*, BRAZIL. Hemmed in between a wide bay and forest-covered mountains, the city of Rio de Janeiro is one of the most important seaports in South America, and it is the third largest city on the continent. It is an old city, and consequently one of interesting contrasts, for the old and the new lie side by side. Stretching along island-studded Rio de Janeiro Bay for miles, it has one of the world's finest, most beautiful harbors.

Some of "Rio's" encircling mountains dip down into the bay, the most famous being Sugarloaf, which rises 1,280 feet above the harbor entrance. From its summit, reached by cable car, one sees the Atlantic on one side; the city on its hill-dotted plain, on the other. Atop sharp-pointed 2,310-foot Corcovado (Hunch-back Mt.) stands a giant statue of Christ.

A broad boulevard, Avenida Beira Mar,

skirts the bay and leads out to the Praia de Copacabana, one of the Atlantic's most famous beaches. Along this beautiful drive are many trees, parks, squares, colorfully designed mosaic sidewalks, and fine buildings, including the palaces later used as the President's office and residence.

Near the junction of this boulevard and the Avenida Rio Branco, the main business street, are many stately public buildings. Among these are the world-famous Municipal Theater, National Museum, National Library, Academy of Fine Arts, and Monroe Palace. Striking examples of modern architecture are numerous. Also outstanding are Rio's botanical garden; Oswaldo Cruz Institute, a world-famous medical research organization; the University of Brazil; and Santos Dumont Airport.

Rio de Janeiro's wealth comes chiefly from its foreign trade. It is the market for a vast coffee-growing region, and this pro-

duct is the city's chief export. It is also the largest railroad center of Brazil. Manufacturing is not well developed, the most important products being flour, textiles, and grist-mill products.

The site of the city was settled by the French in 1555, but the French were driven out by the Portuguese, who founded the present city in 1567. It was capital of Brazil from 1762 until 1960. The population is about 3,000,000.

RIO DE LA PLATA, *plah' tah*. One of the most important commercial waterways in South America is the Rio de la Plata, a wedge-shaped estuary which pushes in from the Atlantic Ocean between Argentine and Uruguay. The Paraná and Uruguay rivers enter the Plata at its head, and it expands to a width of about 140 miles at its mouth. Because of the silt brought down from the river valleys above, it is necessary to dredge the channels in places, to make the river navigable. As a result it is navigable for ocean vessels for its entire length of nearly 200 miles, and a large foreign trade is carried on at the large port cities of Montevideo, Buenos Aires, and La Plata. Díaz de Solís discovered the estuary in 1516, but its name was given by Sebastian Cabot, who visited it in 1526.

RIO GRANDE, *grahn' day*. Rising in the Rocky Mountains of Southwestern Colorado, the Rio Grande follows a course of over 2,000 miles to the Gulf of Mexico, which it enters near Brownsville, Tex. It flows south through New Mexico to the Texas border, and from El Paso to the Gulf it forms the boundary line between Mexico and Texas. It drains an area of 232,000 square miles. Since the end of the Mexican War, in 1848, when the Rio Grande was established as part of the international boundary, the river has changed its lower course several times, thus giving rise to a shifting boundary. A United States-Mexican boundary commission worked for many years surveying the boundary. At high water the river overflows its banks in places, depositing rich, alluvial soil which makes valuable farm land. The Elephant Butte Dam, on

the Rio Grande in New Mexico, is a Federal irrigation project.

RIVERS. Of the three chief agencies constantly at work changing the details of the earth's surface—wind, ice, and running water—the last is most important. Rivers not only cut down land into valleys and wear away hills and plains, but also build up new land into deltas, alluvial fans, and piedmont and flood plains. Their economic value has been incalculable.

From earliest times, rivers have served as highways. Thousands of years before Christ, the Nile and the Euphrates were practically the only means of communication for their valley populations, and over them was carried a commerce extensive for those times. Aside from the Nile, the rivers of Africa are of limited use in commerce because of the rim of high land all around that continent near its edge, which causes falls a short distance from the river mouths. This fact accounts in part for the slow penetration of Africa.

In Asia the Yangtze and Ganges rivers have for centuries been the only important highways for their respective regions. In South America the rubber forests, the grain and cacao plantations, and the ranches have been largely dependent upon rivers for transportation of goods. The Amazon system has the longest navigable mileage of any river system in the world. Ocean vessels are able to ascend the main stream for over 2,000 miles, and by this means alone have traders pierced the jungle to carry away the rubber and cacao beans.

The excellent distribution of rivers in North America is responsible for the early development of the interior. Before Pennsylvania, the Carolinas, and Georgia had been colonized, French priests, traders, and explorers were paddling their canoes up and down the Mississippi and Missouri and advancing westward from Lake Superior to the Red River of the North. Without the Saint Lawrence-Great Lakes system and the Mississippi, the settlement of the interior would have been delayed for perhaps two or three centuries.

Through the gap in the Allegheny Plateau made by the Mohawk River and through Cumberland Gap, cut by a former stream in the Cumberland Plateau, early settlers penetrated the Appalachian barrier to the central plains. There the Ohio and other tributaries of the Mississippi, as well as the Mississippi itself, provided easy transportation over the fertile prairie region.

An important project of public interest in the United States and Canada today is the improvement of the connections between the Mississippi and Great Lakes waterways, to adapt them to the use of modern vessels and provide a complete inland waterway (see GREAT LAKES, THE).

Where navigable rivers joined was usually an advantageous place for a city, as at Saint Louis and Pittsburgh, while water power from rivers furnished opportunities for the development of manufacturing places, as at Saint Paul and Minneapolis and the cities along the Fall Line on the Atlantic seaboard. Rivers are also valuable sources of irrigation water.

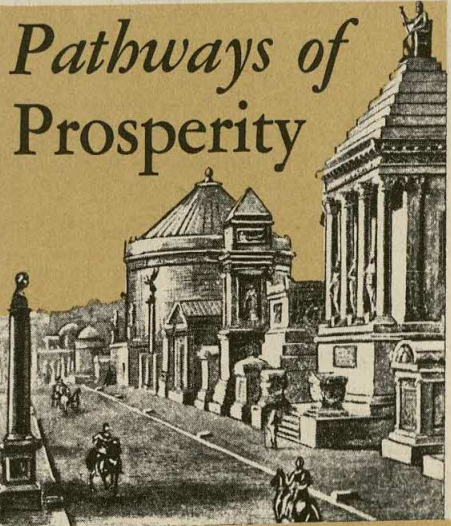
The important rivers of the world are described under separate headings. See, also:

Alluvium	Flood
Canyon	Flood Plain
Cataract	Geology
Dam	Irrigation
Delta	Physical Geography
Divide	Valley
Estuary	Water Power

RIVIERA, *re vya' rah*. Sparkling seas, mild, sunshiny days, and entrancing beauty attract thousands of vacationers to the Riviera, a narrow strip of coast line in France and Italy which extends for 172 miles along the Gulf of Genoa. Verdure-clad heights in the background, bright-colored houses, and gay flowers give this area a fairy-like atmosphere. A fine motor highway, the Grand Corniche Drive, follows the crest of the mountains between Nice and Mentone. Towns and cities of the Riviera include Nice and Mentone, in France; Monaco and Monte Carlo in Monaco principality; Genoa, San Remo, Rapallo, and Spezia, in Italy.

ROAD RUNNER. Inhabiting the southwestern part of the United States is the road runner, a fleet member of the cuckoo family that delights in sprinting along roads in front of horses and cars. The bird is about the size of a crow, with a tail as long as its body. It is a streaky brown in color, with a bronze-colored head and white breast. An odd little crest of feathers surmounts the bird's head. The road runner seldom uses its wings.

Often called *ground cuckoo*, *chaparral cock*, or *snake killer*, the road runner feeds on centipedes, snails, mice, lizards, small snakes, and young birds. Its nest is built in low bushes or on the ground.

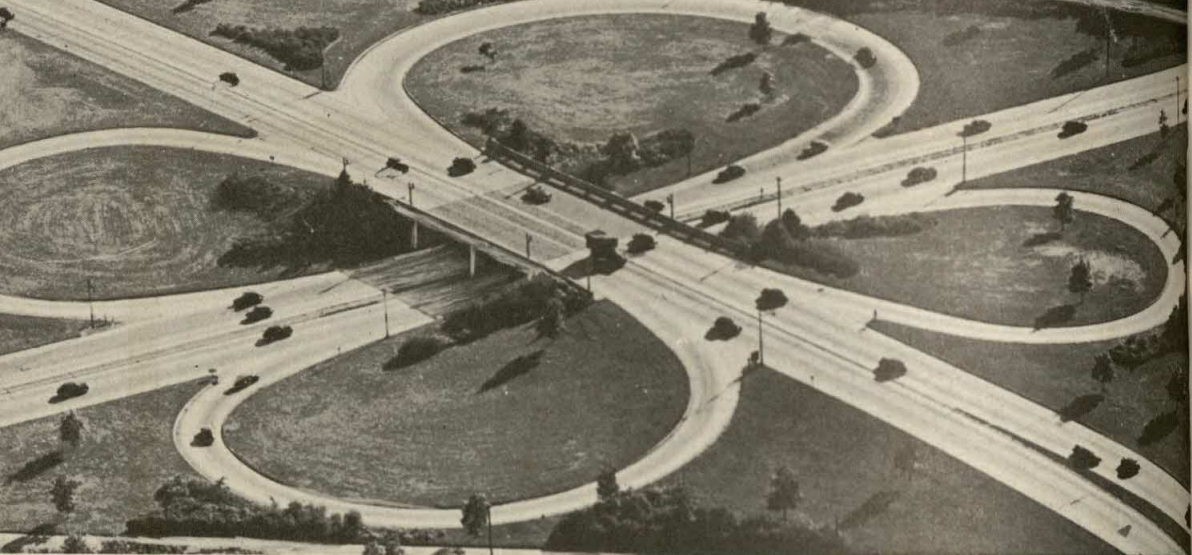


WHEN ROME RULED THE WORLD

The great Appian Way, paved with blocks of lava, stretched from the Eternal City to Brindisi, for miles lined with noble mansions.

ROADS AND STREETS. Ever since men turned from pastures and grain fields to live in towns and cities, there have been roads and streets. In the earliest days roads were necessary for military purposes, for the collection of tribute from the people, and for transporting supplies to armies. Convenience in trade and travel for the common citizen was only incidental. But today, roads and streets serve many purposes.

Within the limits of a city, town, or village, streets permit easy transportation,



Standard Oil Co. (N.J.)

HIGHWAY CLOVER LEAF

Where traffic is heavy, highway engineers try to avoid dangerous right-angle intersections with underpasses and curved approaches.

bringing about a unified citizenry. They make possible the distribution of goods. From the city to the country, roads serve to bring people close together. They reach territories the railroads do not penetrate, thus creating additional transportation facilities. Both roads and streets increase land values. In wartime, roads have an extremely important function, for they are the means of transporting supplies, troops, and ammunition.

Roads and streets today loom more important in the affairs of men than ever before, owing to the rapid increase in the number of automobiles, trucks and buses. The automobile has become one of man's chief forms of transportation, especially in America, and the improvement of roads and streets has come about because of the need of providing a smooth surface for motor vehicles.

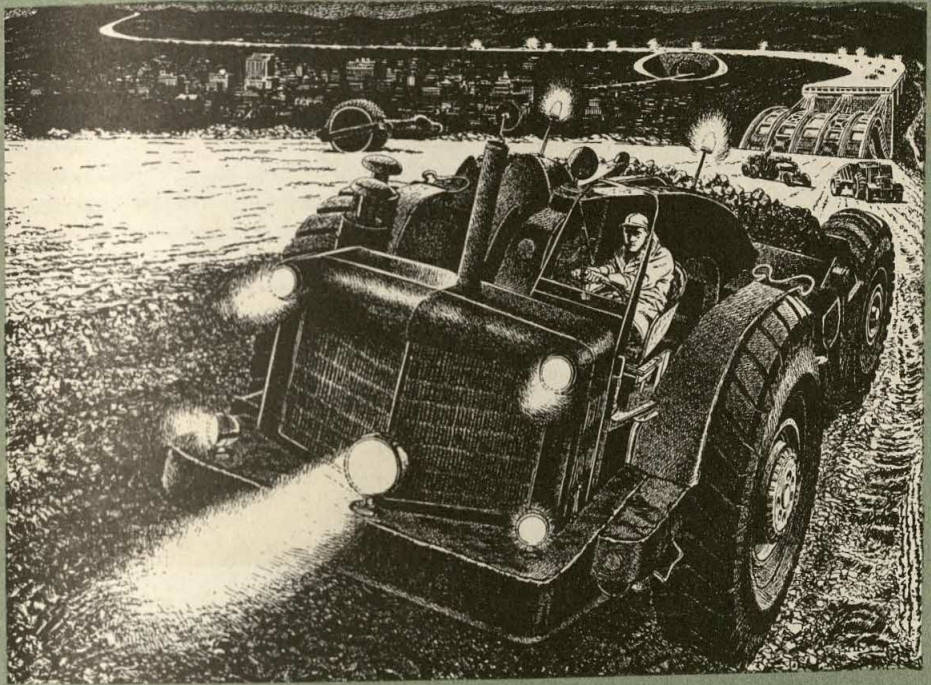
Building Roads. Most roads and streets are built by a government body, which may be national or local. Money is raised by property taxes, tolls, bond issues, and a variety of other means.

In building a road or street, the governmental body in charge first surveys the site of the road. Its next step is to gain possession of the property (if it does not already own it) by direct purchase, or, if the owner objects, by condemnation proceedings. Obstructions standing in the way are then removed, and the site of the road is excavated, graded, and shaped. The foundation

is then placed and the road constructed with filler, a binder of some tar or oil, and a surface. All good roads or streets are crowned, that is, made to slope on either side so that water will run off easily. Curbs are placed on either side of a street to catch the water; ditches are dug along the sides of roads or highways.

Various materials are used in the construction of roads and streets. Today, the most popular pavement is concrete (see CONCRETE). Bituminous macadam, bituminous mixed macadam, sheet asphalt, bituminous concrete, brick, wood blocks, and stone blocks are other familiar pavement materials.

The Story of Roads. Man early learned the importance of roads as a means of unifying a nation, and we read that the ancient Persians built a network of roads from the city of Susa to various parts of their empire. The Greeks, however, were not extensive road builders, for they lived in city states which remained separate from one another; and the people felt that there was no need for means of communication. The Romans, on the other hand, with their widespread empire, were fine road builders, constructing their highways of well-cut stone. During the Middle Ages, roads

*Delco-Remy*

FAST WORK ON A ROADWAY

Torn-up roads mean delay, confusion, and much inconvenience. Construction crews sometimes work night and day to shorten the time the highway is out of service. They haul materials and build pavement from both ends to complete that last short gap as quickly as possible. Powerful lights and radio communication between construction foreman and crew keep the pavement growing at top speed.

were little more than dirt paths; and most people walked, rode on horses, and carried their goods by oxcart. This condition existed almost up to the nineteenth century, although during the Renaissance many cities built wide avenues and squares.

Two Scottish engineers in the eighteenth and nineteenth centuries changed roads from dirt wagon trails to good surfaces. They were Thomas Telford, who devised the process of placing small stones over stone blocks, and John L. McAdam, inventor of the macadam process of placing small and broken rocks in a smooth surface directly over the earth. Napoleon also had a part in the history of road building, and he constructed many fine roads for his armies.

In America, the Aztecs and the South American Indians constructed good roads.

Some of the Spanish conquerors of Mexico and South America also built paved roads. Farther north, the early colonists gradually built a few dirt roads between their hamlets, towns, and cities. Nevertheless, North America's rivers and lakes, and later its canals and railroads, were the principal avenues used by the pioneers who moved across the continent and opened up the West.

In the 1890's, when the bicycle reached the height of its popularity, an improvement in roads became necessary in the United States; and the coming of the automobile launched an era of road and street improvement. Today the increase in traffic has created special problems in road and street building. Many of the old two-lane highways which crisscross the nations are inadequate to care for heavy traffic, and some

of the most important of these roads are being widened to four-lane highways. Cities, finding their streets overcrowded, are building elevated express highways and are experimenting with streets of several levels. Important street intersections are being designed with underpasses, viaducts, and other safety devices to eliminate congested and unsafe traffic conditions.

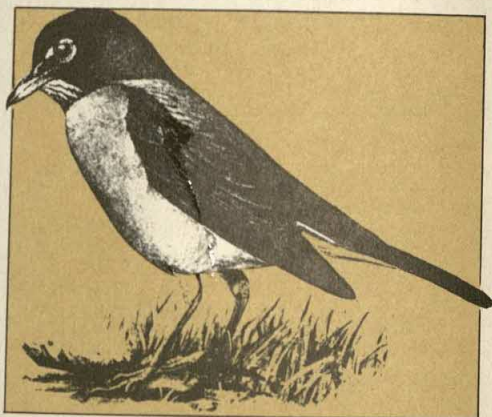
ROBERTS, OWEN JOSEPHUS (1875-1955). Previous to his appointment as an Associate Justice of the United States Supreme Court in 1930 by President Hoover, Owen Roberts had achieved a distinguished record as a lawyer. Born in Philadelphia, he was educated at the University of Pennsylvania and began his legal career as district attorney for Philadelphia County. He later served as professor of law at the state university. In 1924 he represented the government in the Teapot Dome oil cases. Justice Roberts was head of the committee that investigated the Pearl Harbor disaster of December 7, 1941.

ROBESPIERRE, *ro bes p'yare'*, MAXIMILIEN MARIE ISIDORE (1758-1794). Violence and bloodshed are associated with the name of Robespierre, most prominent of the leaders of the French Revolution. He was largely responsible for the bloody Reign of Terror in the Revolution, yet he always maintained, and historians have borne him out, that his only reason for terrorism was to pave the way for an ideal and unified society.

Robespierre, who was born at Arras, received a good education and practiced law in his native city. It is interesting to note that this man, who later sent dozens to their deaths, resigned a position as criminal judge because he would not pronounce a death sentence. One of the middle-class liberals, he was elected to the States-General in 1789, and in that historic body became a member of the radical group. When the Revolution broke out, he took a prominent part and was one of those who brought about the execution of Louis XVI. He and Danton overthrew the Girondists and instituted the Reign of Terror, but when

Danton urged less bloodshed, Robespierre turned on Danton and sent him to the guillotine.

Such power was sure to breed enemies. Robespierre, supreme though he seemed to be during the Reign of Terror, was opposed in the Convention in July, 1794, and accused of being a despot. He was thrown into prison and was executed on July 28, 1794. See FRENCH REVOLUTION.



ON THE WINGS OF SPRING

The robin is one of the first birds to tell Northerners that springtime has come again.

ROB'IN. When the first robin of the year puts in his appearance in the northern part of the United States, spring is never far behind, for this member of the thrush family usually is a harbinger of winter's end. The American robin is about ten inches long, has a dark-brown body, black head, and reddish-orange breast. His song, while not especially beautiful, may be easily identified. Robins build nests of straw, grass, and rootlets, plastered together with mud. The nest, located in the fork of a tree or on some convenient ledge of a building, is usually built near the last one, for robins become fond of a location and return to it year after year. Four pale-blue eggs are laid, and their color has become known as "robin's-egg blue."

Robins attack insect pests vigorously, but also love ripe cherries and rob the farmer of a considerable part of his fruit. But their value in eating insects and worms outweighs the damage they do. When the

frosts arrive in the fall, the robins start flying southward, and remain in their winter homes until the following spring.

ROBIN HOOD. Old English ballads celebrate the exploits of Robin Hood, the legendary bold outlaw of Sherwood Forest, who robbed from the rich, gave to the poor, and generally made himself a nuisance to clergy, nobles, and royalty.

Robin and his merry band, composed of such lusty and colorful men as Little John, Friar Tuck, Allan-a-Dale, William Scathlock, George-a-Greene, and the beautiful Maid Marian, dwelt in Nottinghamshire. Here they killed the king's deer for food, which was against the law, and encountered many adventures which have come down to us in stories and legends. All the members of the band were experts with the yew bow, and most of them were equally adept at cracking skulls when the need arose.

The special enemy of Robin was the sheriff who was pledged to capture the outlaw and bring him to justice. But Robin always evaded him, and some stories tell how Robin tricked him and fleeced him of his money.

According to legend, Robin lived in the latter part of the twelfth century, while Richard the Lion-Hearted and King John ruled. He is said to have been a Saxon knight who was dispossessed of his estate. Seeking vengeance, he became an outlaw, banded together a number of followers, married Maid Marian, and indulged in any number of romantic escapades. He is said to have been honored by King Richard but hated by King John, and to have died because of the treachery of a relative who permitted him to bleed to death when he was ill.

The stories of Robin Hood are the creations of the English peasants. He was their ideal, a hero who voiced all their resentment against the oppression of the ruling classes. He represented their devout faith in Christianity and their hatred of the monks and clergymen who taxed them heavily. Since the peasants were yeomen, skilled in the use of the yew bow, Robin

was given the talents of a superb archer. Because there was still resentment at this time against the Normans who had conquered England, he represented the Saxon spirit rebelling against the Norman foe. Above all, Robin typified the common people, who were treated badly, taxed unjustly, and made to serve a conquering enemy who had come from France. The fact that a man named Robin Hood probably never existed is unimportant, but what he represented was typical of the age. Reginald De Koven's melodious operetta, *Robin Hood*, enjoys enduring popularity.

ROB ROY (1671-1734). Not so well known as the tales of Robin Hood, but far more authentic than these legends, are the stories of Rob Roy, Scotland's notorious outlaw of the early eighteenth century. His real name was Robert Macgregor, but he was forced to change it to Campbell when the Macgregor clan was banished by law.

He received the name Roy, which means *red*, because of his ruddy complexion and red hair. Rob Roy became a cattle raiser in the Scottish Highlands, and gradually organized a band of men to protect his flocks from thieves. Later, when he could not pay back a debt to the Duke of Montrose, he turned outlaw, robbing the duke of his cattle and otherwise harassing him and other nobles. Rob Roy could not be captured, but finally, in 1722, he gave himself up to the English, who placed him in prison for a time and then pardoned him. He is the hero of a novel by Sir Walter Scott and the leading character in a light opera.

ROC, rok. Purely an imaginary creature, the roc is a huge bird mentioned in the Arabian myth of *Sinbad the Sailor*. In this interesting tale, Sinbad discovered a roc's egg so large that the distance around it was fifty paces. When the giant bird hovered over the egg, Sinbad tied himself to its leg and was borne away.

ROCHAMBEAU, *ro shahN boh'*, JEAN BAPTISTE DONATIEN DE VIMEUR, Comte de (1725-1807). A distinguished marshal of the French army, the Comte de Rochambeau was the leader of one of the French forces



*Courtesy Warner Bros. Production
"The Adventures of Robin Hood"*

ENGLAND'S MERRY OUTLAW

The green glades of Sherwood Forest rang with the shouts of Robin Hood's merry men as they indulged in friendly bouts with the quarterstaff. Top, the leader, with Much, the Miller's son, and Little John. Left, below, archery contest. Right, Friar Tuck carries Robin. Bottom, the hero.



which aided the American colonists during the Revolutionary War. Arriving in America in 1780 with 6,000 men, Rochambeau awaited orders from Washington. After a year in Rhode Island, being inactive because of the English blockade, he gave valuable aid at the Siege of Yorktown.

Trained for the priesthood as a youth, Rochambeau had entered the French army in 1742. After his return to France from America, he was made governor of Artois and Picardy. He joined the Revolutionary movement, was elevated to the position of marshal in 1791, and in 1792 commanded the Army of the North, but resigned because he disliked the excesses of the French leaders. He lost his title and property during the Reign of Terror, but they were later restored by Napoleon.

ROCHESTER, N. Y. Famous as a music center and home of the largest film and camera factory in the world, Rochester is the third largest city in the state of New York. It is located on the Genesee River, and is a beautifully planned city with fine buildings and parks. Highland Park is the center of the city's famous lilac festival. It is because of its large nursery industry and parks that Rochester has won the name of "Flower City."

Among the cultural and educational institutions are the University of Rochester, Saint Bernard's Seminary, Nazareth College, Colgate-Rochester Divinity School, Rochester Civic Music Association, the Philharmonic Orchestra, and the Eastman School of Music.

Rochester is the market for a large agricultural region. The photographic industry dominates the industries of the city, followed by the manufacture of scientific instruments and clothing. Most of the power used in the city is furnished by the falls in the Genesee River, 260 feet high. Rochester was incorporated as a village in 1817. It grew rapidly with the development of the Erie Canal. The population is about 320,000.

ROCK. The masses of solid mineral material that make up the crust of the earth

are called rocks. The term is restricted to the larger masses, and is usually not applied to minor masses such as veins and ore bodies.

Rocks may be hard, as granite, limestone, and sandstone; or they may be loose mineral aggregations like sand, clay, or gravel. The latter are called the *unconsolidated* rocks, and, when present, occur as a cover over the surface of the hard rocks. This cover may occasionally reach a thickness of hundreds of feet, but always below it there are solid rocks. Soil is the thin top layer of the unconsolidated rocks, which is filled with and modified by the remains of plant growth.

All rocks are of three kinds, classified according to the way in which they were formed.

Igneous rocks are those that have become solid by cooling of molten rock material (see **IGNEOUS ROCKS**).

Sedimentary rocks are those which have been carried and deposited either by the wind or by water. These are also called *stratified* rocks from the fact that the wind and the water assort the materials they carry and deposit them in layers, or strata, composed of grains of differing sizes or materials.

Metamorphic rocks are rocks of either of the first two kinds which have been greatly altered after they were deposited (see **METAMORPHISM**).

The original rock is igneous in its origin. This is slowly acted upon by the weather—by freezing and thawing, and by rain and wind and ice—so that it gradually disintegrates. Portions of it are dissolved by water and carried away in solution. These dissolved materials are chiefly lime, magnesia, potash, and soda. The more insoluble parts of the rocks are left behind—chiefly the quartz, iron, and clay. See **GEOLOGY**.

ROCKEFELLER, JOHN DAVISON (1839-1937). From the world's great oil resources, particularly those in the United States, John D. Rockefeller amassed a great fortune, becoming, at one time, the world's richest man and later America's foremost

philanthropist. Before he died, at the age of ninety-eight, his contributions to education, to the advancement of medicine, and to religious and charitable institutions exceeded \$530,000,000. He divided \$400,000,000 of this sum among the General Education Board, the Rockefeller Foundation, the Rockefeller Institute for Medical Research, and the Laura Spelman Rockefeller Memorial, all founded by him.

Rockefeller was born in Tioga County, N. Y., and, in 1853, moved to Cleveland with his parents. When he was nineteen he entered the commission business, and a few years later became engaged in an oil-refining enterprise. At the age of thirty-one he headed the Standard Oil Company, which grew to be the largest oil company in America.

In 1911 Rockefeller retired from active business with a fortune reputedly worth one billion dollars. In the early 1890's he had become interested in founding a Middle Western university, and he gave the University of Chicago contributions which amounted to about \$35,000,000. From his retirement until his death, Rockefeller devoted his time to giving money to such enterprises as seemed worthy. One of these was the Rockefeller Foundation, which he founded in 1913 to deal with problems of philanthropy throughout the world. The Institute for Medical Research, established in 1901, has laboratories in New York City and Princeton, N. J.

John Davison Rockefeller, Jr. (1874-1960). Like his father, John D. Rockefeller, Jr., was a philanthropist. He carried on charitable enterprises and also financed great projects such as Rockefeller Center in New York City. He was born in Cleveland. On the retirement of his father he succeeded to the management of the oil interests. The younger Rockefeller gave large sums of money for the restoration of several French palaces and cathedrals, as well as the colonial buildings of Williamsburg, Va.

ROCKET. The type of rocket that paints a night sky in vivid color on the

Fourth of July is familiar to every child. The rocket as a war weapon, and as an instrument to probe the skies for science, is a much more complicated mechanism. It entered the history of World War II when the Germans launched "flying bombs," against England. Later came the German V-2 rocket, a twelve-ton weapon carrying a ton of explosive in its nose. Ingenious as they were, these first projectiles were not too effective as weapons. Rocket-firing guns, on the other hand, used as land or naval artillery, made possible saturation barrages of enemy strong points.

Experiments with captured V-2 rockets in the United States opened up a new world for science. The first postwar modifications of the V-2 hurtled through space at speeds of better than a mile a second and soared more than 100 miles above the earth. In their warheads they carried a "flying laboratory." Instruments recorded data on cosmic rays, temperature, air pressure, and other weather information in the upper atmosphere.

A rocket, such as the V-2, burns alcohol and liquid oxygen. Pumped into the engine, these burn at an extremely high temperature. The hot gases stream from the combustion chamber at a velocity of more than 6,000 feet a second. This creates the forward thrust that propels the rocket.

The rocket principle is also used in aircraft. Rocket planes are capable of much greater speeds than old-style propeller-driven airplanes, but, because of their high fuel consumption, can make short flights only. They differ from jet-propelled planes chiefly in that they carry their own oxygen. See AIRPLANE.

ROCKY MOUNTAINS. Towering skyscrapers, magnificent bridges, massive dams, and great excavations all pale into insignificance beside the colorful grandeur and lofty peaks of the Rocky Mountains.

The name is applied to the ranges of mountains which extend from New Mexico to Alaska between the Great Plains on the east and the so-called Great Basin on the west. They are a part of the Cordillera



NEAR THE CONTINENTAL DIVIDE

The superb scenery of the soaring Rocky Mountains attracts thousands of sight-seers every season; there are breath-taking views from every lofty vantage point.

system which extends far into South America. As the "backbone of North America," the Rockies form an important feature of the earth's surface, and from Colorado into Canada, where they are known as the Canadian Rockies, they contain the lengthy watershed called the Continental Divide.

Many ranges compose the Rocky Mountains. In New Mexico and especially in Colorado, the Sawatch and Sangre de Cristo ranges rise to magnificent heights. Colorado has forty-six peaks over 14,000 feet high, tallest of which is Mount Elbert (14,431 feet), tenth highest mountain in the United States. The Uinta and Wasatch ranges of Utah also contain many summits of more than 12,000 feet.

In Wyoming is the spectacular Teton Range, with its rugged, granite peaks. Grand Teton is the chief mountain, rising to a height of 13,747 feet. The long Wind River Mountains, containing Fremont Peak (13,720 feet) and Gannett Peak (13,785 feet), are also in Wyoming, as are the Big Horn Mountains, with towering Cloud Peak (13,165 feet).

Farther north, the Rockies generally are

not quite so high, although the Beartooth Mountains in Montana have numerous peaks over 12,000 feet in altitude. The Bitterroot Mountains form the western boundary of Montana, and to their west lies a veritable mass of summits. The wild and formidable Lewis Mountains extend beyond Helena.

As the Rockies cross into Canada, the ridges generally become straighter and more glacial. The tallest peak is Mount Robson (12,975 feet). In Alaska the Rockies comprise a region little explored, but it is one of white grandeur.

Perhaps the most famous pass through the Rockies is the South Pass in Central Wyoming, through which thousands of westward-bound settlers followed the Oregon Trail. The Great Divide Basin, or Laramie Plains, in Wyoming; the Columbia plateau, lying west of the Bitterroot Mountains, and the Colorado plateau in the south are celebrated plateaus of the Rockies, forming passes which figured in the westward expansion of America.

Character of the Rockies. Formed partly by volcanic action and the wrinkling of the earth's crust, the Rocky Mountains

are well named, for many of the peaks are composed of granite and gneiss. Great areas of alluvial soil have been deposited by streams at the bases of the mountains. The region is best suited for grazing, as the altitude is too high, the slopes too steep, and the rainfall too slight for raising crops. Through irrigation in the valleys, however, orchards have been created and considerable fruit is grown, especially in Colorado. The slopes are covered with timber up to the tree line. Created many thousands of years later than the Appalachians, the Rockies are comparatively young, and have not been so worn down by the elements. The many rich mineral treasures found in the Rockies include gold, silver, copper, lead, zinc, manganese, uranium, and coal.

In the northwestern part of the United States, the land between the Rockies and the Pacific receives abundant rainfall from the moisture-laden Pacific breezes; the Dakotas and Eastern Montana and Wyoming, on the other hand, are dry, for the breezes lose almost all their moisture on the western slopes. Farther south the vast area to the west of the Rockies is all desert, robbed of rainfall by the Sierra Nevadas, but toward the east the country receives a moderate rainfall from the Gulf.

With good highways, the development of extensive National Parks, and the popularity of the "dude ranch," the Rockies have become a favorite playground for outdoor lovers. The icy streams abound with fighting trout, wild animals attract hunters, and the panorama of scenery draws the tourist there. See PARKS, NATIONAL.

ROCKY MOUNTAIN PARK. See PARKS, NATIONAL.

ROCKY MOUNTAIN WHITE GOAT.

So clever and wary is the Rocky Mountain white goat that hunters who are successful in bagging one consider the capture a real achievement. The only wild goat in North America, it inhabits high peaks in the Canadian and American Rockies, in the Cascades, and in the Alaskan ranges. The animal stands about three feet high at the shoulder, and is garbed in a coat of coarse,

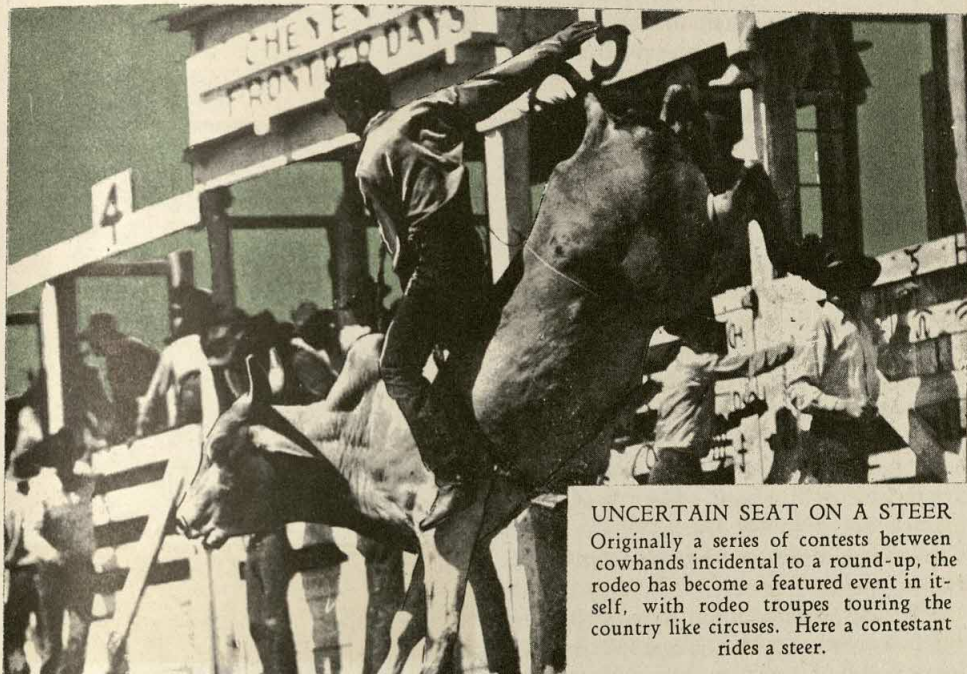


David L. Spencer, Fish and Wildlife Service
HIGH CLIMBER GROUNDED
Quick and agile in action, the Rocky Mountain goat looks slow and clumsy when at rest.

white hair which cannot be easily distinguished from the snow. Both male and female have slender, backward-curving horns, sleek, black hoofs, and a pronounced hump on the back. Remarkably sure-footed, these active creatures can scamper along a rocky ledge a few inches wide, a feat that few other animals attempt. They are valued for both their flesh and their hides.

RODENTS, or RODENTIA. These mammals can be recognized most readily by their peculiar front teeth (incisors), which are remarkably adapted to cutting or gnawing. Their food ranges from succulent grasses, grain, and fruit to hard-coated nuts and the bark on roots and trunk of trees. There may be four upper and two lower front teeth, as in the rabbits, or only two in both upper and lower jaw, as in the porcupines, mice, pocket gophers, beavers, squirrels, and chipmunks.

Examination of these front teeth will show that the cutting edge is shaped like a chisel and that it is kept constantly sharpened by the gnawing. The teeth extend far back into the jawbone and continue to grow and push outward practically through-



UNCERTAIN SEAT ON A STEER

Originally a series of contests between cowhands incidental to a round-up, the rodeo has become a featured event in itself, with rodeo troupes touring the country like circuses. Here a contestant rides a steer.

out life; thus they do not become worn out by the hard use to which they are put. The teeth in the back of the mouth are adapted for grinding up the food.

Some rodents, including the muskrat and beaver, are exceedingly valuable as fur bearers, while others, as certain rats, mice, ground squirrels, prairie dogs, and pocket gophers, are such seriously destructive pests as to make necessary the use of control measures.

Consult the following articles for descriptions of various rodents:

Agouti	Lemming
Beaver	Mouse
Chinchilla	Muskrat
Chipmunk	Pika
Flying Squirrel	Porcupine
Gopher	Prairie Dog
Guinea Pig	Rabbit
Hare	Rat
Hedgehog	Squirrel

Vole

RODEO, ro' de o, or ro da' o. Riding tossing, bucking broncos, lassoing lively steers, wrangling stubborn, balky cattle, and trick horseback riding are some of the exciting events that take place in a rodeo, the West's own form of amusement.

A rodeo originally was a round-up of cattle, but today it consists of contests of skill between cowboys. In the towns of the West, a rodeo is given each year, and in some cities like Cheyenne, Wyo., Pendleton, Ore., and Calgary, Alta., the annual rodeos are festive events, widely publicized. The first organized rodeo was held in Denver in 1896; and since that time, rules have been standardized. Cash prizes are usually given to the winners of the various events.

RODIN, ro daN', AUGUSTE (1840-1917). It is doubtful if any other sculptor has even approached the ruggedness and unusual feeling that Auguste Rodin has imparted to his world-famous works of art. Certain it is that he was the greatest French sculptor of his century and one of the most outstanding of all time.

A native son of Paris, Rodin launched his career at an early age, for his *Man with a Broken Nose* was executed when he was but twenty-four. He was a member of the French National Guard during the Franco-German War of 1870, after which he lived and worked in Brussels for a time. His *Age of Bronze* was exhibited at Paris in 1877,

and attracted wide attention because of its startling realism. His next works were *Saint John Preaching* and *The Thinker*, the latter being his best-known work. His *Burghers of Calais*, *Adam and Eve*, *The Bather*, *The Kiss*, and *The Sphinx* are other crowning achievements of his incomparable genius.

Not only is his work outstanding because of its amazing symbolism and individuality, but to Rodin also goes the credit for a new finish for sculptured art—a rough, loaf-sugar type of surface that has now almost replaced the glossy finishes of a century ago.

ROE. The eggs of fishes, called roe, are sometimes used as food. The roe of sturgeon is probably the most valuable as a food, as it is widely used in making caviar (see CAVIAR).

The eggs of some fishes float. Perch lay eggs in ribbons from two to seven feet long. Some fish, among them sticklebacks, bullheads (catfish), and black bass, place their eggs in carefully prepared nests. Most fish, however, do not do this. To lay their eggs, fish may run upstream, migrate to shallows, remain where they are, or run downstream. Eels run downstream, salmon run upstream.

ROEBLING, *ro' bling*, JOHN AUGUSTUS (1806-1869). In 1855 the famous suspension bridge across the gorge of the Niagara River was completed. It was designed and constructed by John Augustus Roebling, a pioneer in the building of suspension bridges. Born in Muhlhausen, Germany, and educated as a civil engineer in Berlin, Roebling emigrated to America in 1831 and settled in Pittsburgh. He was made assistant engineer of slack-water navigation on the Beaver River, and later surveyed the route of the Pennsylvania Railroad across the Allegheny Mountains. He began the manufacture of wire rope, using it in his new method for building suspension bridges and aqueducts. His success won him the contract to build the Niagara Bridge, which then was one of the greatest suspension bridges in the world.



LE PENSEUR

This work of the great Rodin, *The Thinker*, is from his heroic group, *The Gate of Hell*.

The fame which this work brought secured for Roebling the commission to build the Brooklyn Bridge in New York City. Construction was begun in 1869; but while the work was being planned, there was an accident in which his foot was injured. Tetanus developed, taking his life; and his son, Washington Augustus Roebling, also a noted engineer, carried the work to completion. See BRIDGE.

ROE'BUCK. One of the tiniest species of deer known to man is the European roe-buck, whose height at the shoulders seldom

exceeds two feet. Of reddish brown color in summer, its coat changes in winter to a peculiar olive shade. Roebucks live in pairs, mating for life. On their heads are mounted short antlers, each terminating in two sharp tines. They are usually peaceful animals but, when annoyed by hunters, they sometimes attack ferociously and, in spite of their small size, can prove quite dangerous.

ROENTGEN, *runt' jun*, WILHELM KONRAD VON (1845-1923), was the German physicist who discovered the remarkable form of radiation called *X rays*, or *roentgen rays*. In 1895, while teaching physics at the University of Wurzburg, he was experimenting with a Crookes tube. During his experiments he noticed that sensitive papers beside the apparatus became exposed while the tube was in operation. Since he did not know the nature of the rays, he merely called them *X*, or unknown, rays. They were later named in his honor but now are more commonly known by the original name. In 1901 Roentgen was awarded the Nobel prize in physics for his discovery.

Roentgen was born at Lennep, Prussia, and was educated at universities in Zurich and Utrecht. Besides teaching at Wurzburg he also was a professor at Strassburg, Giessen, and Munich. See *X Rays*.

ROLAND. All that was best in chivalry belonged to Roland, the hero of the French epic, *Song of Roland*. Brave, handsome, loyal, gallant, he was a staunch warrior and upholder of right. Legends tell us that Roland was the nephew of Charlemagne, and that he fought against the Saracens in the Battle of Roncesvalles (778). Here, it is said, he was killed, dying a hero's death after a bitter struggle.

Roland is known to people other than the French. In Italian literature he is the famed Orlando, the hero of Ariosto's *Orlando Furioso* and of Boiardo's epic *Orlando Innamorato*.

ROLFE, JOHN (1585-1622). America's tobacco industry had its beginnings with John Rolfe, an early settler of Virginia. Rolfe, who came to Jamestown Colony in

1610, is said to have been the first white man to cultivate the golden leaf that is so much in demand today. He is also noted in American history as the husband of Pocahontas, the Indian maiden, whom he took with him to England. See *POCAHONTAS*.

ROMAN CATHOLIC CHURCH. With approximately 510,000,000 members in all parts of the world, the Roman Catholic Church is the largest Christian religious body. In North America there are about 96,198,000 members, of whom some 39,500,000 are in the United States and about 6,000,000 in Canada.

According to the belief of the Church, the Roman Catholic Church was founded by Jesus Christ, who ordained the Apostle Peter as the first bishop, or overlord, of the Christian religion; and Peter's successor is the Pope of Rome, whom the faithful regard as its supreme, visible head.

Organized under the supreme rule of the Pope, the Church regards the Pope's pronouncements on questions of faith and morals as infallible, since he is believed to receive divine guidance on these matters. Thus the faithful members of the Church submit absolutely to the supreme authority of the Pope in this regard. The Pope is assisted in guiding the affairs of the Church by his deputies, the clergy, who are organized on a hierarchical basis beginning with the Pope at the top, followed by the cardinals, sacred congregations, patriarchs, archbishops, bishops, apostolic delegates, vicars, and prefects, abbots, and others.

According to the present law of the Western, or Latin, Rite, all members of the clergy must remain unmarried so that they may devote their full efforts to their spiritual duties. This law has undergone many variations but is now followed by all priests where Latin is the Church language and Western customs are accepted.

The belief of the Church is contained in the Apostles', Nicene, and Athanasian creeds and that of Pius IV, promulgated after the Council of Trent in 1562. The Roman Catholic belief is based on faith; that is, all members of the Church must



SCIENCE STUDY BEGINS EARLY

Children in Catholic schools learn some rudiments of the great field of scientific knowledge even in the first grade. Here youngsters watch the action of tails and fins of swimming goldfish, while on the wall is a chart of a bird's body. There are 9,900 Catholic elementary schools in the United States, with a total enrollment of 4,200,000. Catholic high schools, numbering 1,600, have an enrollment of 520,000. Higher education is provided by 265 Catholic colleges and universities. Canada also has an extensive Catholic school system.

New World

TRADITION AND MODERNISM MEET ON CAMPUS

UPI

Symbolizing the blending of the traditional and the modern in Catholic education is this scene at the College of the Holy Names, Oakland, California.



THE CENTER OF CATHOLIC WORSHIP IS THE ALTAR

The high altar at the Subiaco Abbey (opposite page), Subiaco, Ark., is typical of altars in Catholic churches that have been built recently. It is a fine example of modern ecclesiastical art, successfully combining old and new styles. The altar proper is the stone table, on which rest the candlesticks and the tabernacle, a casket holding the sacred vessels. Over the altar hangs a large crucifix, which is a cross with the figure of Christ on it. The crucifix is suspended from the canopy, a dome-like hood of gold-plated metal. Four marble columns support the arch to which the canopy is attached. Behind the altar is a window of colored glass, which shows a Biblical scene. All the parts of the altar and its surroundings have a symbolic meaning—the steps, the candles, the central panel, and other elements. Catholic altars are designed in a variety of styles, but all must include certain essentials, such as the crucifix. Besides the high, or central altar, most churches also have a number of smaller altars.

*Courtesy of Daprato Studios,
Chicago and New York*

SPIRITUAL LEADER OF
HALF A BILLION ROMAN
CATHOLICS THROUGHOUT
WORLD

This portrait of Pope John XXIII was painted soon after he was elected in November, 1958. The Pope wears a red cape over his white garments, and stands before his golden throne. Previous to his election, Pope John XXIII was Cardinal Angelo Roncalli, a leading member of the Vatican diplomatic staff. Like all Popes, he took a new name when he assumed his new rank. "John" recalls John the Apostle, John the Evangelist, and other saints named John.

Cardell Greetings, Inc.



Joannes F. F. X XIII



accept the belief without question. The Church teaches that God created the universe, and that after man fell from grace, God sent His Son Jesus to show men a new way of life and a means to regain grace, and that His Son was crucified to atone for the sins of man. Catholics also believe that after His crucifixion, Christ arose to complete the work of founding His Church, which is the Roman Catholic Church. They consider that the Church is infallible in matters of doctrine and morals, and through Baptism and Penance it acts as the mediator of Christ in forgiving sins.

Catholics believe that the most important ways of regaining grace lie in the seven sacraments of the Church, which bestow God's grace on the faithful. These sacraments include the Holy Eucharist, which, the Church teaches, was ordained by Christ at the Last Supper and in which the bread and wine are actually transformed into the body and blood, soul and divinity of Christ. The offering of the Eucharist as a Sacrifice, with its prayers and ceremonies, is called the mass. The taking of Holy Orders is another important sacrament, by means of which the clergy is set apart from the laity and given the spiritual power to perform its sacred duties. The clergy's power to administer the sacraments is believed to be conferred by God.

Among the other sacraments are Baptism, Penance, Confirmation, Matrimony, and Extreme Unction. The Catholic Church further teaches that man's ultimate destination is either Heaven or Hell and that those who have lived in obedience to the teachings of Christ are assured of Heaven, and those who remain unrepentant sinners are assured of Hell. However, to be admitted to Heaven, the faithful must be completely free of sin, and those who are not free of sin must be purified in Purgatory before they may enter the Kingdom of Heaven. The Church also teaches the second coming of Christ, when all mankind shall be judged and the redeemed shall be taken by Jesus in immortal life.

The Church believes in the power of the

saints to aid those who ask for help, in the Immaculate Conception of the Blessed Virgin Mary and the virgin birth of Jesus Christ, and in miracles. The Virgin Mary, although she cannot be worshiped as a divine being, is the most honored of all saints in the Church. All the essential belief of the Church is drawn from the Bible and tradition, and is interpreted by the Pope and his councils.

Consult the following titles for additional information:

Abbey	Litany
Ave Maria	Mary, The Virgin
Canonization	Mass
Canon Law	Monasticism
Cardinal	Papal States
Christianity	Pope
Counter-Reformation	Priest
Eucharist	Reformation, The
Inquisition	Rosary
Jesus Christ	Vatican City

ROMANCE, *ro mans'*, LANGUAGES.

The languages of many of the peoples in Southern and Southwestern Europe trace their origin directly to the Latin language, spread by the Romans wherever they conquered new provinces. The Romance languages, however, are descendants of the Latin spoken by the common people, rather than of literary Latin. While these languages are each distinct from the other, they nevertheless have marked resemblances. Among those included in this group are French, Spanish, Italian, Portuguese, and Rumanian. See LATIN LANGUAGE.

ROMAN LAW. See CIVIL LAW.

ROMAN NUMERALS. A system of number symbols used by the Romans, Roman numerals are no longer used in arithmetical calculations, having been replaced by the simpler Arabic numerals. They are, however, still frequently used in other ways—in numbering the volumes in a set of books, in indicating the hours on clocks, and in inscriptions on buildings.

The chief disadvantages of the Roman system lay in the fact that there was no zero and that it was difficult to add, multiply, subtract, or divide. It is thought that the Roman numeral system originated from

counting on the fingers, as *I* for 1; *II* for 2, etc. For the number 5, it was customary to draw a slant line across four vertical lines, and from this idea the symbol *V* for 5 probably developed. The number 10, written *X*, is really two *V*'s placed point to point. *C*, which stands for 100, is the first letter of *centum*, the Latin word for *hundred*. *M*, the symbol for 1,000, is the first letter of *mille*, the Latin word for *thousand*. *L* is the symbol for 50; *D* for 500.

Other numbers are indicated by adding and subtracting. A smaller numeral written before a larger is subtracted from the larger; for example 4 is indicated by *IV*; 40 by *XL*. A smaller numeral written after a larger is added to the larger; for example, 7 is indicated by *VII*; 60 by *LX*.

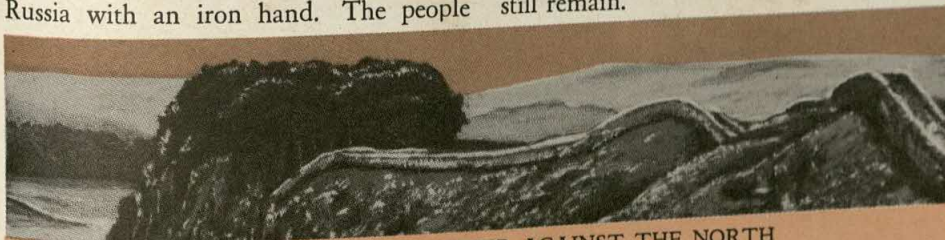
ROMANOFF, *ro' man awf*. For three centuries members of the Romanoff family guided the destinies of the great Russian Empire. The line first came to power in 1613 and ended its long rule when Nicholas II was forced to abdicate in 1917, during the Russian Revolution. The first of the Romanoffs, Michael Feodorovitch Romanoff, was chosen by the Russian nobles as their leader in 1613 and was given the title *czar*. Nineteen Romanoffs followed Michael to the throne, but the family was distinguished by only two outstanding rulers, Peter the Great and Catharine the Great, a Romanoff by marriage. Peter came to the throne to find the country totally disorganized and undeveloped. Through his efforts, it became one of Europe's most brilliant centers. Catharine, a clever and diplomatic empress, won respect and prestige for Russia.

The Romanoffs and their officials ruled Russia with an iron hand. The people

were given no voice in the government until the establishment of the Duma, or legislative assembly, in 1905, and this body had practically no power until many years later. This short-sighted policy finally led to the downfall of the imperial family in 1917, for the people had gained enough political strength to revolt; on March 5 the Duma forced the czar to abdicate. Nicholas attempted to name Michael, his brother, as his successor, but the latter refused the throne. The czar and his family were imprisoned in the Tsarkoe-Selo Palace, and were later taken to Tobolsk, Siberia. On June 16, 1918, they were executed at Ekaterinburg.

ROMANS, *EPISTLE TO THE*. Probably written at Corinth in A. D. 57 or 58, the *Epistle to the Romans* was one of the most important letters of the Apostle Paul. In it he set forth his doctrine of justification through faith alone, a doctrine which was adopted by Martin Luther as the cornerstone of his revolt against the Catholic hierarchy. It is an important part of the belief of most Protestant churches. This epistle forms the sixth book of the New Testament.

ROMAN WALLS. Built across the northern boundary of Britain, the Roman Walls served to protect the Roman colonies from the invasions of the barbarous Picts and Scots of the north. The first wall was the Wall of Hadrian, constructed probably between A. D. 122 and 126 from the Tyne to the Solway. About A. D. 142, Antoninus Pius built an earth wall between the Forth and Clyde rivers which marked the northernmost limits of the Roman occupancy in Britain. Portions of these walls still remain.



HADRIAN'S WALL. BARRIER AGAINST THE NORTH

Part of the defensive wall built by the Romans from the mouth of the Tyne to Solway Firth.

City of IMPERIAL SPLENDOR



AGE-OLD ROME

The city abounds in historic associations. Top, the Castle of Sant' Angelo, on the Tiber. Left, Julius Caesar, Emperor. Right, the Capitoline she-wolf.



ROME. Pagan monuments mingle with Renaissance cathedrals, beautiful palaces, and lovely gardens in the city of Rome. Here, on the banks of the Tiber River, seventeen miles from the sea, is the center of the Roman Catholic Church. Since it became part of the nation in 1871, it has been the capital of Italy. Rome's celebrated seven hills, first settled more than 700 years before Christ, have seen prosperity and famine, wealth and poverty; and today they present evidence of every age of Western civilization.

"Queen of Land and Sea." Ancient Rome was in her glory during the reign of Emperor Augustus, from 27 B. C. until A. D. 14. When Augustus came to power, Rome was a city of crooked, narrow streets and brick buildings. At the time of his death, marble had replaced brick, and temples, theaters, porticoes, and public baths adorned the metropolis. In those days, a high wall surrounded the city. Parks were laid out in various parts of the

city, and bridges gave access to both sides of the Tiber. Public meetings were held in the forums, the principal one being the *Forum Romanum*. The famed *Via Sacra* (Sacred Way) was the main thoroughfare of ancient Rome, and the Flaminian Way (north) and the Appian Way (south) were the two main roads leading from the city.

Some of the most noted temples of ancient Rome were the Jupiter Capitolinus on the Capitoline Hill; the Pantheon, which still stands; the Temple of Apollo, on the Palatine; the Temple of Minerva; the Temple of Peace; the Temple of the Sun, and the Temple of Venus. The emperors lived on the Palatine Hill. The Colosseum, which may still be seen, was the largest of the amphitheaters.

Beautiful columns and triumphal arches, magnificently decorated with sculpture, were erected in Rome to celebrate victories and honor outstanding leaders from time to time. Some of these are still standing after hundreds of years. The Column of Trajan is another relic to be found in the



Pan American World Airways

EVEN IN RUINS, THE ROMAN FORUM IS A SYMBOL OF PAST GRANDEUR

The old Roman Forum was built in a valley between the Capitoline and Palatine Hills about the beginning of the Christian Era. Once the scene of battles between the Romans and Sabines, it was set apart as a meeting place for public functions. Here were delivered many of Rome's most famous orations and edicts. The ruins were excavated during the 19th and 20th centuries.

ruins of the once-splendid forum.

The City Today. When the Roman Empire fell, Rome declined. During the Middle Ages, it had only about 20,000 people. Today, its population is about 2,100,000. A third-century, many-gated wall almost surrounds the city and ten bridges cross the Tiber. The Piazza del Popolo, on the

north side of Rome, is the principal square. The Quirinal Palace, residence of former kings, is near the center of the city. The Capitol crowns the Capitoline Hill, and ruins mark the Palatine Hill and the area surrounding it.

Saint Peter's and the Cathedral of Saint John Lateran are the most famous of the



ROMAN LEGIONS FALL BACK BEFORE THE GERMANS

Three times Germanicus, nephew of Emperor Tiberius, invaded the gloomy forests of Germany seeking revenge for the defeat of Varus. Three times he was forced to retreat by the aroused German tribesmen under Hermann, wielder of the terrible two-handed sword.

great churches. The University of Rome is the leading educational institution; others include the Collegio Romano; the Collegio de Propaganda Fide, where youths are trained to become Catholic missionaries; and the American Academy in Rome. The Vatican contains many of the great art treasures of the world, and another notable museum is the Capitoline Museum.

Trade in Rome is relatively small. Water transportation is available only to small craft, and railroad facilities are somewhat limited. Manufactures are not of great importance; in normal times, they include silk goods, jewelry, objects of art, earthenware, macaroni, soap, and tobacco.

The Pope was the ruler of the city during most of the Middle Ages; but Rome was often sacked, not only by barbarians,

but by armies of dukes and nobles who resisted the Pope's temporal powers. In 1527 the Constable of Bourbon sacked the city, and the French took it in 1798. Mazzini and Garibaldi formed a republic in Rome by driving Pope Pius IX from the city in 1848. The following year Rome was under the Pope's reign through the aid of French troops; but in 1870 the Italian army occupied it again. In 1871 Rome became the capital of United Italy. Today all the affairs of the nation are governed from Rome, which became the capital of republican Italy in 1946.

For additional information, consult the following articles:

Arch	Forum
Campus Martius	Mussolini, Benito
Circus	Pantheon
Colosseum	Saint Peter's Church
	Vatican City

THE ROMAN EMPIRE

Map showing the Roman Empire at its greatest extent (under Trajan) 98 to 117 A.D. The map includes the following regions and bodies of water:

- Regions/Provinces:** SARMATIA, GERMANIA, BRITANNIA, GALLIA, HISPANIA, MAURETANIA, AFRICA, INTERNUM, ASIA, ARMENIA, MESOPOTAMIA, EGYPTUS, MACEDONIA, ILLYRICUM, ITALIA.
- Bodies of Water:** OCEANUS ATLANTICUS, MARE CASPIUM, PONTUS EUXINUS, MARE.
- Decorative Elements:** Several figures of Roman soldiers in various poses are placed across the map, including one in Britannia, one in Germania, one in Hispania, one in Macedonia, one in Armenia, and one in Egyptus.

THE ROMAN EMPIRE AT ITS GREATEST EXTENT
(UNDER TRAJAN) 98 TO 117 A.D.

THE ROMAN EMPIRE AT ITS GREATEST EXTENT
(UNDER TRAJAN) 98 TO 117 A.D.



CAESAR MAKES HISTORY—AND A PROVERB

Leading his legions across the river Rubicon, out of his own province in Gaul, Julius Caesar defied Roman law. It meant either triumph or colossal failure; Caesar took the chance and conquered Rome. Ever since then, the phrase "crossing the Rubicon" has been applied to any fateful or momentous decision.

ROME, HISTORY OF. Egypt gave birth to many phases of our civilization; Greece raised culture to its highest point; but to Rome goes the glory of spreading the learning and arts of mankind throughout the Western World. Although never approaching the cultural creativeness of Greece, Rome was an inventor—a practical inventor. Instead of philosophy, she gave us laws; instead of tragic dramas, gave us the oratory of statesmen; instead of setting an example of rule through small, centralized city states, Rome built an empire that gave the world lessons in the art of government.

Roman civilization has often been criticized because its culture was borrowed from the Greeks; yet the Romans contributed many things that were of their own making. In architecture they developed the dome and the arch; in sculpture they turned from the idealism of Greece to wonderfully realistic portraits; in litera-

ture they popularized comedy and contributed epic poems, histories, and scientific discourses. Their language, Latin, is today the basis of the so-called Romance languages (see **LATIN LANGUAGE**) and has added immeasurably to English; it is also the universal language of law, science, and the Church. Rome was a great engineering nation, constructing miles of enduring roads and numerous long-lasting aqueducts and bridges. The Roman army has served as a model to later nations for its discipline and organization.

There are four main reasons to account for Rome's fall. Slavery weakened her social structure, creating demands that the empire finally could not meet. The army became less and less Roman and, therefore, less powerful with the influx of captive soldiers. Christianity undermined the strength of the autocratic form of government on which Rome rested. And, finally, the barbaric invasions dealt the



IN THE ROMAN FORUM

A prominent monument of the Roman Forum is the Arch of Septimius Severus, dedicated to the "Barracks Emperor" of that name.



MARCH 15, 44 B. C.

As had been predicted, Julius Caesar was assassinated on the Ides of March, by Roman aristocrats he thought were friends.

blow that killed Roman supremacy.

The Period of the Kings. Rome's story begins in legend. It is said that Aeneas, after the Trojan War, went to Italy, where he founded a league of cities. Then, in 753 B. C., the myths say, Romulus founded the city on the Palatine, one of the seven hills on the left bank of the Tiber; and the city grew as a refuge for outlaws. After many struggles, it finally was united with the Sabines.

Kings were the first rulers of Rome, and they conquered the cities of Latium, whose inhabitants they took to Rome as plebeians without political rights. The king was elected by the people, and the Senate, composed of members of important families, assisted him. In addition, there was an assembly elected by the people to make the laws.

Romulus, who is regarded as the first

king, was succeeded by six kings—Numa Pompilius, Tullus Hostilius, Ancus Marcius, Tarquinius Priscus, Servius Tullius, and Tarquinius Superbus—and during their reigns, the plebeians fought constantly for equal rights. Finally, about 500 B. C., Superbus was driven from the throne, and Rome became a republic under two consuls elected from among the patricians.

The Period of the Republic. In 494 B. C., the plebeians won representation in government affairs with the creation of the office of tribune of the people. There were two tribunes at first, but finally ten. Later the plebeians succeeded in having a code of laws drafted, and the result was the famous Twelve Tables on which Rome based her later government. Class strife resulted in other reforms, such as inter-marriage between patricians and plebeians



By Deane Dickason, from Ewing Galloway, N.Y.

CITY WITHIN A CITY — VATICAN CITY IN ROME

The feet of millions of pilgrims have crossed the Piazza Saint Peter to reach huge, historic Saint Peter's Church. Close by is the Vatican, residence of the Pope.

and the appointment of military tribunes.

During the time of this internal strife, Rome carried on a number of foreign wars. As the nation expanded, the Romans came into conflict with Carthage, the great Phoenician city state in North Africa. In 264 B. C. the Romans and Carthaginians began the first Punic War, which ended in 241 B. C. with a Roman victory. The two powers went to war again in 218 B. C., and when this second struggle was finished, Carthage was forced to cede her rival all her colonies and pay an annual tribute.

Turning to the east, Rome launched a campaign for the wealth of Macedonia and Greece and their colonies. A Roman army defeated Philip V of Macedon at Cynoscephalae in 197 B. C., and in 168 B. C. Rome conquered an alliance of Greek states. Greece and the remnant of the Macedonian Empire became a Roman province in 146 B. C., the same year that Roman legions were successful against Hannibal at the end of the Third Punic War. Carthage was finally destroyed, and Northern Africa, too, became a province

of Rome.

Despite the gains of the plebeians, the nobility of Rome controlled the government offices at this time, and there was continued internal strife. The Gracchi (Tiberius and Gaius) had sought to better conditions; but when Gaius, the younger of the Gracchi, died in 121 B. C., the government again became corrupt. The Social War, which began in 90 B. C., had a profound effect on Roman history. The Italian allies, who for a long time had asked for Roman citizenship, revolted in that year. At the end of the war, two years later, they won the coveted citizenship. A rivalry between Marius and Sulla later developed into a conspiracy led by Catiline in 63 B. C. It was exposed by Cicero, whose eloquent orations in the Senate drove Catiline into exile.

Then began a period of transition, when great men dominated Roman history. The First Triumvirate, consisting of Caesar, Crassus, and Pompey, was formed in 60 B. C., after important conquests in the north. Caesar was assassinated in 44 B. C., and the Second Triumvirate, composed of



Shell Oil Company

HISTORY'S MOST AMAZING HIGHWAY SYSTEM

Roman engineers, working largely by rule-of-thumb, were centuries ahead of their time in the construction of roads and aqueducts. Many historians have claimed that a major reason Rome endured so long was excellent transportation provided by its network of roads. Many of these, such as the Appian Way, may still be seen.

Octavius, Antony, and Lepidus, came to power the next year. Octavius finally emerged as the sole leader of Rome. He became the first emperor (Augustus) 27 B.C., and Rome rose to new heights.

The Period of the Empire. After Augustus, Tiberius became emperor A.D. 14. Under the reigns of Caligula, Claudius, and Nero, the number of Christians steadily grew.

Britain was conquered and became a Roman province under Claudius, and Rome was burned while Nero was on the throne. After Nero came three tyrants—Galba, Otho, and Vitellius. In 69, Vespasian, a strong ruler, came to power. Under him and his sons, Titus and Domitian, Rome enjoyed a period of peace and prosperity. Then came the "five good emperors," Nerva,

Trajan, Hadrian, Antonius Pius, and Marcus Aurelius. Under Trajan, the Roman Empire reached its greatest extent.

Rome began to decline in 180 under Commodus. Septimius Severus, who followed him, gave the Christians more freedom, but corruption in the army and government further weakened the empire's power. In 222 Alexander Severus came to power and tried to reform the government and army. This was followed by a short period of anarchy which lasted until 268. The empire seemed about to fall apart, but was saved for about 200 years, although Diocletian's persecution of the Christians and his division of rule with Maximian sowed the seeds for the inevitable fall.

Constantine the Great became sole emperor in 324; he adopted Christianity for the state religion and moved the capital to Byzantium, renaming it Constantinople. Then the breakup of the empire became definite. Constantine died in 337, and his sons warred among themselves for the throne. Constantius became emperor, then Julian the Apostate, and, finally, the joint emperors—Valentinian in the West and Valens in the East.

The provinces, which had been governed well despite the internal disorders, now became restless, and wars and barbarian invasions forced many changes. The Visigoths crossed the Danube and settled in the Eastern Empire to escape the Huns, but unfair treatment caused them to rebel and defeat the Romans in 378. Theodosius the Great conquered the Visigoths when he became ruler (379-395). Upon Theodosius' death, Arcadius, his son, became emperor of the East, and Honorius, another son, came into control of the West.

The great empire was now definitely split, and the barbarian hordes pressing down from the north were able to ravage without great resistance. The Goths, although checked for awhile, invaded Italy and sacked Rome. The legions were withdrawn from the provinces to protect the homeland, and the empire collapsed. The Visigoths took Southern France and

Spain, and the Vandals took Northern Africa. Then came Attila the Hun; with one last desperate flourish, the Romans and the Visigoths defeated him at Châlons in 451. Attila then marched to Rome, but Pope Leo I induced him to leave. Rome was sacked in 455 by Genseric, the Vandal, and emperors came and went until 472.

Ironically, the last Roman emperor, like the first king, was named Romulus. He was dethroned in 476, and Odoacer took the title of king of Italy. In 800 an attempt was made to restore the ancient glory of Rome when Charlemagne was crowned emperor, but his domain was by no means the empire that once resounded to the march of Caesar's legions.

For additional information, consult the following articles:

GENERAL TOPICS

Aeneid	Plebeians
Augurs	Praetor
Byzantine Empire	Praetorian Guard
Carthage	Punic Wars
Censors	Quirinal
Etruria	Tarpeian Rock
Gladiator	Tiber
Goths	Tribune
Huns	Triumph
Legion	Triumvirate
Lictors	Tunic
Literature	Twelve Tables, Law of the
Patrician	

BIOGRAPHY

Agricola, Gnaeus	Julian
Antony, Mark	Justinian I
Augustus	Livy
Aurelian, Lucius	Mithridates
Aurelius, Marcus	Nero
Brutus, Marcus	Pliny (the Elder and the Younger)
Caesar, Caius Julius	Pompey
Catiline	Pyrrhus
Cato, Marcus Porcius	Romulus
Cato, Marcus Porcius (the Elder)	Scipio, Publius (father and son)
Cicero, Marcus Tullius	Seneca, Lucius
Claudius	Tacitus, Publius
Cleopatra	Tarquinius, Lucius
Constantine	Theodoric
Diocletian	Theodosius
Gracchus	Tiberius
Hadrian	Titus (emperor)
Hamilcar Barca	Trajan
Hannibal	Vergil
Horace	

Vespasian

ROMULUS. Just as the Greeks created myths concerning the founding of their cities, so the Romans made up stories about the origin of the city that once ruled the world. The story most Romans believed was that of Romulus, from whom the name of Rome is said to have been derived.

The legend goes that Romulus, and a twin brother, Remus, were born to Silvia and Mars. A cruel uncle, Amulius, who had usurped the throne of the land held by Silvia's father, Numitor, placed the infants in a basket and set it afloat on the Tiber, where he hoped they would be destroyed. Instead, the basket floated to the foot of Palatine Hill, where the brothers were brought up by a she-wolf, and were nursed by her. Later, one of the king's shepherds, Faustulus, found them and taught them their lessons.

When they grew up they avenged their mother by restoring Numitor to the throne. Then they decided to found a city. They consulted an oracle, and when the omens decreed that Romulus should have the honor, he gathered his men about him and built the city on the Palatine Hill. In a quarrel between the two brothers, Remus was killed. Since Romulus and his followers were regarded by neighboring people as outlaws, they were compelled to steal their wives from the Sabines, with whom they engaged in war. Peace was finally declared, and Romulus and the Sabine king ruled jointly. Then, suddenly, Romulus disappeared in a thunderstorm, and the people of Rome began to worship him, giving him the name Quirinus.

ROOK. European members of the crow family, the rooks feed upon both plants and insects. Their plumage is of deep, glossy purple, but the feathers about the head are lost by the adult birds. Rooks live in colonies known as rookeries, and usually migrate south during the cold months.

ROOSEVELT, FRANKLIN DELANO (1882-1945). When Franklin Delano Roosevelt accepted the Democratic nomination for the Presidency of the United States in July, 1932, no one fully realized the scope and

daring of his plans for the social, economic, and political regeneration of a depression-ridden country. After the election was won and he had taken over the reins of the government as the thirty-second President, Roosevelt boldly proceeded to outline a far-reaching program to cure the social and economic "sick spots" of the United States. This program sought to replace the traditional American philosophy of rugged individualism with a new doctrine based on the abolition of social injustices, special privilege, and unfair business practices.

The "New Deal" resulted in an avalanche of legislation covering numerous social and economic phases. Some of these laws represented necessary and beneficial reforms; most of them represented the new position the government had taken regarding its duties and obligations to its citizens. Most of the opposition to the Roosevelt administration claimed that the new legislation slowed down business and industry because of governmental interference and heavy taxation. The extension of the powers of the government and the centralization of control in the Federal government were also criticized.

Early Life. From an illustrious and successful Dutch colonial family, Franklin D. Roosevelt drew a fine heritage for his keen sense of social responsibility. The only child of James and Sara Delano Roosevelt, he was born on January 30, 1882, at Hyde Park, Dutchess County, N. Y. At the age of fourteen he entered Groton (Mass.) preparatory school. He graduated from Harvard University in 1904 and from Columbia University Law School three years later. In 1905, while a law student, he married Anna Eleanor Roosevelt, his sixth cousin and a niece of Theodore Roosevelt. To them were born six children, one of whom died in infancy.

For a time, Franklin Roosevelt engaged in the practice of law in New York City, but in 1910 he was nominated for the state senate on the Democratic ticket in his home county. He campaigned vigorously and enthusiastically and was elected in a normally

Republican district. He ardently fought against the election of the Tammany candidate for the United States Senate and brought about the selection of another candidate. In 1912 Roosevelt was re-elected by an even greater margin of votes than in his first campaign.

The "Middle"

Years. In 1912 Roosevelt, an admirer of Woodrow Wilson, supported Wilson in the Presidential campaign. In the next year he was given the post of Assistant Secretary of the Navy under Josephus Daniels. During the First World War he conducted the activities of the Navy Department with remarkable skill, building up the Naval Reserve and later organizing the Naval Overseas Transportation Service. He was in charge of inspection of American naval forces in European waters, and after the Armistice supervised their demobilization.

His work won for Roosevelt the nomination for Vice-President on the Democratic ticket in 1920, but he was defeated by the general swing away from the Democrats. Stricken with infantile paralysis in 1921, Roosevelt was forced into political retirement for several years while he fought a courageous battle against the disease.

In 1924 and 1928, Roosevelt nominated Governor Alfred E. Smith of New York as Democratic candidate for President of the United States. Urged to run for governor to succeed Smith in 1928, Roosevelt carried the state by a plurality of 25,000 votes and was re-elected in 1930 by a plurality of

725,000. As governor, he inaugurated a policy of reform which provided for a State Power Authority, unemployment relief, advanced labor legislation, a reformed tax system, and a plan for reforestation.

Chosen as a candidate for President in 1932, Roosevelt waged a remarkable campaign which took him to all parts of the country. He won the election, defeating President Hoover by a plurality of 7,054,520 votes.

President Franklin

D. Roosevelt. Immediately following his inauguration, on March 4, 1933, the new President asked Congress for executive authority to deal with the economic emergency facing the country. The continued closing of thousands of banks necessitated immediate action, and on March 6, two days after he assumed office, President

Roosevelt declared a national bank moratorium. For about a week the banks remained closed, while they reorganized their finances; sound banks were later permitted to reopen. On March 9 the Seventy-third Congress was called into special session, and the President asked for and received special powers to deal with the depression.

To President Roosevelt was given authority to regulate credit, banking, foreign exchange, and currency. Hoarding of gold was made illegal, and on April 20 the United States went off the gold standard. Shortly, clauses in contracts providing for payments in gold were voided, and the gold content of the dollar was decreased. Later in the year, the Twenty-first Amendment to the



FRANKLIN DELANO ROOSEVELT
Thirty-second President
Administration: 1933-1945

Huge governmental expenditures and much social legislation marked the "New Deal" administration of Franklin D. Roosevelt.

Constitution, repealing the Eighteenth Amendment, went into effect.

Early in his administration the President attempted to stimulate employment and raise wages through the National Industrial Recovery Act establishing the National Recovery Administration (NRA). The law was declared unconstitutional in 1935. An Agricultural Adjustment Act, authorizing the government to control farm production (AAA program), was declared illegal in 1936; but the AAA program was continued under another law.

Other legislation included the creation of the Civilian Conservation Corps; acts providing for Federal relief and a program of public works to relieve unemployment; the Glass-Steagall Banking Act, authorizing limited insurance on bank deposits; an act creating the TVA Board; the Securities Exchange Act; and laws starting home-loan and housing programs.

The Seventy-fourth Congress passed laws regulating public utilities; the Social Security Act, designed to provide unemployment insurance and old-age pensions; the Wagner Labor Relations Act; and several bills providing for higher taxes on incomes and a tax on the surplus and undistributed profits of corporations.

The activities of the administration were not confined to domestic problems. With the assistance of Secretary of State Cordell Hull, the President took an active part in world affairs. Reciprocal trade agreements were signed with a number of other countries, and a Good Neighbor policy in Latin America was consistently followed.

Reelected with John N. Garner in 1936 over Alfred M. Landon and Colonel Frank Knox, President Roosevelt continued the New Deal program. He was defeated in his attempt to enlarge the Supreme Court by legislation, but eventually won his objective—a more liberal Court—by filling vacancies with men of advanced views. A serious recurrence of the depression, late in 1937, led to demands for a more friendly attitude toward business, and the Congress that met in January, 1938, passed a revenue

act revising the capital-gains and undistributed-profits taxes. A Wage-Hour Act, fixing minimum wages and maximum hours for workers in industries engaged in interstate commerce, also was passed. The administration won a victory for its power program when the Supreme Court upheld the TVA.

In the primaries preceding the fall elections of 1938, the President was largely unsuccessful in his efforts to "purge" the Democratic party of anti-New Dealers; and in the November elections the Republicans made strong gains. These various results were regarded as a protest against the President's alleged efforts to secure greater personal power; as disapproval of sit-down strikes and tolerance of labor violence; and a dissatisfaction over government extravagance and continued deficits. Yet the President retained much of his personal popularity.

In the first session of the Seventy-sixth Congress, the President obtained the right to reorganize the executive branch of the government, subject to Congressional approval. He took a vigorous stand against the methods used by Adolf Hitler in expanding Germany, and after the outbreak of World War II, in September, 1939, he called Congress in special session to consider neutrality legislation. The Neutrality Act passed at this session permitted the sale of war planes and other materials to belligerents on a cash-and-carry basis.

At the last regular 1940 session, Congress levied higher taxes, increased the national debt limit, and authorized billions of dollars for expansion of national defenses.

President Roosevelt was elected for an unprecedented third term in November, 1940. In 1941, he signed the Lend-Lease Act. The sudden attack on United States possessions in the Pacific in December brought the country into the war, and Congress granted the President almost unlimited power to meet the emergency; he met several times with other Allied leaders on foreign soil. In 1944, he was elected for the fourth time. In February, 1945, he jour-

neyed to Yalta, where he met with the British and Russian leaders. On April 12, he died of cerebral hemorrhage at the "Little White House" at Warm Springs, Ga. Harry S. Truman became President.

For additional information, see:

Farm Relief	Tennessee Valley
Labor Legislation	Authority
Neutrality	World War II

ROOSEVELT, THEODORE (1858-1919).

President of the United States, traveler, writer, sportsman, soldier, and naturalist—all these titles can be placed after the name of Theodore Roosevelt, an outstanding personality in the history of the United States. His amazing vigor and charm made him an outstanding President.

Early Life. Theodore Roosevelt was born on October 27, 1858, in New York City. He came of a well-to-do family of Dutch descent. Young Roosevelt was none too vigorous as a boy, but he developed his body until he was physically strong. He was graduated from Harvard in 1880, studied law at Columbia University for a short time, and in 1881 won a seat in the lower house of the New York legislature on the Republican slate. He immediately attracted notice by a wholehearted attack against political bosses and corruption.

Leaving the legislature after three years, the young politician bought a ranch in North Dakota, where he sought to recover from the shock of losing both his mother and young wife by death on the same day. There was one daughter, Alice, of his first marriage. As a rancher he soon won the respect of the community and learned to ride the range with the best of the cowboys.

In 1886 Roosevelt ran for mayor of New York on the Republican ticket, and was defeated. The same year, in London, he married Edith Kermit Carow. Returning to New York, he entered politics again. Following the election of President Harrison, Roosevelt became chairman of the Civil Service Commission, and vigorously opposed the spoils system. In 1895 he became president of the board of police commissioners of New York City.



THEODORE ROOSEVELT

Twenty-sixth President, 1901-1909

His administration was marked by the Panama Canal treaty, a strong conservation policy, his work for peace, and a firm attitude towards business.

John Hancock Mutual Life Insurance Company

Under President McKinley, Roosevelt served as Assistant Secretary of the Navy, but at the outbreak of the Spanish-American War, he resigned and, with Leonard Wood, organized the First United States Volunteer Cavalry. Known as the "Rough Riders," this volunteer force was composed largely of plainsmen and cowboys. As colonel of the regiment, Roosevelt led an impetuous charge up San Juan Hill that made him a national military hero. His election as governor of New York followed, and he took office on January 1, 1899. Roosevelt's vigorous attempts to regulate large corporations won him no prestige among the political bosses, however, and they conspired to have him placed on the

Republican ticket of 1900 as Vice-President of the United States, hoping to relegate him to obscurity.

Had the bosses known what was ahead, Roosevelt would certainly have never been nominated, for, ten months after the election, President McKinley was the victim of an assassin's bullet, and on September 14, 1901, "T. R." became the twenty-sixth President of the United States. He was then within six weeks of his forty-third birthday. Not only did he fill the rest of McKinley's term, but he was easily elected in 1904 to a four-year term of his own.

Administrations (1901-1909). Announcing that he would carry on McKinley's policies, the new President retained the able Cabinet of his predecessor, in which Elihu Root was Secretary of War and John Hay was Secretary of State. But Roosevelt was too dynamic and independent to be a follower; he hewed his own trails, and his seven and one-half years in the Presidency were marked by reform legislation of a varied nature and by a vigorous foreign policy. The administrations of Theodore Roosevelt were definitely progressive in spirit and in action.

The President's intervention in the anthracite strike of 1902, when he forced the mine owners to consent to arbitration, was an example of his success in getting results. Especially was he skillful in arousing public opinion in behalf of his policies. The reform measures advocated by him and enacted into law included an act abolishing railroad rebates, the Hepburn Railway Rate Act, and meat-inspection and pure-food bills. The government also instituted suits under the Sherman Anti-Trust Act against the Northern Securities Company, the United States Steel Corporation, and the Standard Oil Company.

Of a definitely constructive character were such measures as the creation of the Department of Commerce and Labor (1903), the establishment of the Census Bureau on a permanent basis, the organization of a Bureau of Immigration, and the passage of a uniform naturalization law.

The President advocated military and naval preparedness, and secured a law reorganizing the two branches of the service. Roosevelt was also an enthusiastic friend of the conservation movement. The Reclamation Act of 1902, to further the construction of irrigation projects, and the governors' conference on conservation, which met at the White House in 1908, were in line with his intense interest in the movement.

In 1907 a severe financial panic occurred, and the following year Congress passed the Aldrich-Vreeland Bill, which provided for the issuance of emergency currency. This resulted in the creation of the Monetary Commission in 1910, which eventually led to the formation of the Federal Reserve System under President Wilson.

During his administrations, Roosevelt did much to promote world peace. He persuaded Great Britain to settle her dispute with Venezuela by arbitration, and in 1905 secured a meeting of Russian and Japanese peace commissioners at Portsmouth, N. H., which ended the war between the two countries. For this contribution to world peace, the President received the Nobel Peace Prize the following year.

An outstanding achievement of this administration was the negotiation of an agreement with Panama, in 1903, whereby the Panama Canal became a reality. The efforts of President Roosevelt to come to terms with Colombia were unsuccessful, and the province of Panama revolted and set up an independent republic. The canal was completed in 1913.

The President used his influence to further the candidacy of his Secretary of War, William H. Taft, and the latter was nominated by the Republicans in 1908. He easily defeated his Democratic opponent, William J. Bryan.

As Ex-President. During the first year of Taft's administration, Roosevelt was away, and there was no question of his attempting to dictate the policies of his successor. Active and vigorous as ever, he went first on a hunting trip to Africa, with his son Kermit. From there he went to

Europe, where he was honored in every country he visited. In France, Germany, Norway, and England he lectured at leading universities. Meanwhile a rift in the Republican party had begun to develop, for Taft was displaying conservative tendencies. This rift became an open break in the spring of 1912, when Roosevelt announced that his "hat was in the ring" for the Republican nomination.

The Republican convention, held in Chicago, was dominated by Taft delegates, although Roosevelt had won most of the Republican primary elections. The nomination of Taft was followed by the organization of the Progressive (Bull Moose) party, which nominated Roosevelt for President and Hiram Johnson of California for Vice-President. The campaign was spirited and intensely bitter. Roosevelt split the total Republican vote to the advantage of the Democrats, and Woodrow Wilson was elected, Taft carrying only two states. The new party soon disintegrated, and in 1916 Roosevelt supported Charles Evans Hughes.

Roosevelt made an exploring trip to Brazil in 1913. He discovered a river not then on any map, which was named Rio Teodoro in his honor. At the outbreak of World War I, the veteran of San Juan was openly anti-German. When America joined the conflict he volunteered to lead a division in France, but his offer was rejected. His four sons, however, represented him abroad, and the youngest, Quentin, who served as an aviator, lost his life in France. Roosevelt died in his sleep two months after the signing of the Armistice.

Roosevelt not only left an inspiring record as a statesman and leader, but also twenty-five volumes of history, biography, travel narratives, lectures, essays, and sketches.

Consult the following articles for additional information:

Conservation	Russo-Japanese War
Panama Canal	Taft, William H.

ROOSEVELT DAM. See RECLAMATION, BUREAU OF.

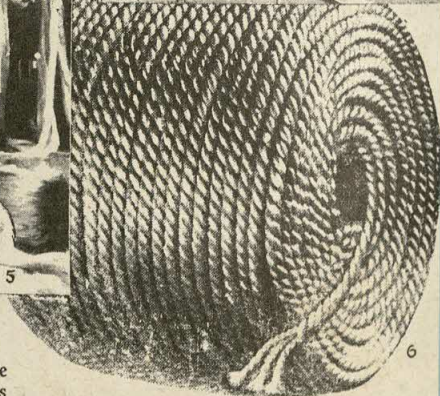
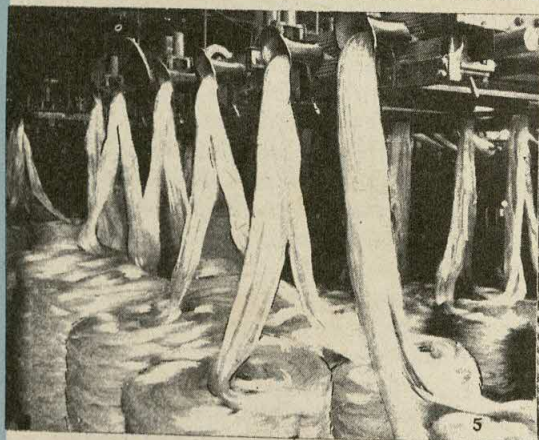
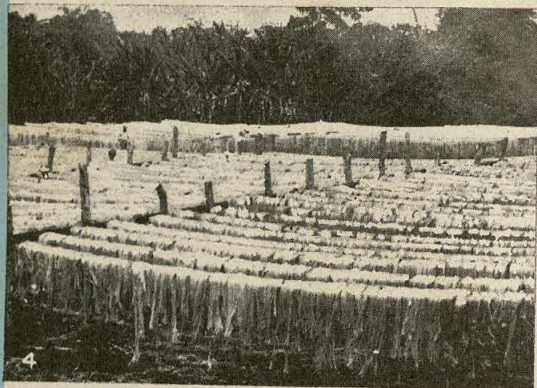
ROOTS. Necessary to the existence of most plants are the roots through which water and plant food are obtained. The roots also act as an anchor for the plant, holding it in the soil. A third function of roots is to store excess food.

Roots usually extend downward from the stem of the plant. The first root is the main root, or primary root. Its branches are the secondary roots. These, too, may have branches. Tiny fibrils, called root hairs, extend from the smaller rootlets; they absorb moisture for the plant (see ABSORPTION). Those roots that originate on any unusual part of the plant are known as *adventitious* roots. Some roots rise from the stem and extend through the air before entering the ground. The mangrove and tree-fern roots are typical examples. The root of the orchid, a typical air plant, never enters the ground (see AIR PLANTS).

Parasitic plants such as the mistletoe send their roots into the plants on which they feed, and some roots, such as those of the plum and cherry trees, develop leaf buds. The roots of the elm send up shoots near the stem of the tree. Some aquatic plants float on the water, and others have their roots in the soil at the bottom (see AQUATIC PLANTS).

ROPE. Made of twisted natural or synthetic fibers or wire, rope is widely used in homes and industries, on ships and farms. Fibers used include abaca, or "Manila hemp," sisal and henequen (from agava plants), true hemp, jute, coir (from coconuts), linen, cotton, and nylon.

Rope is now made almost entirely by machinery by a process which is essentially the same for all types. Before 1820 most rope was made by hand, and this method persists today in certain parts of the world. When the raw vegetable fibers arrive at a modern ropemaking plant, they are first straightened and sprinkled with oil, after which they pass through the *spreader*. From here the fibers are sent through the *breakers*, where the fibers are straightened and arranged in a ribbon called the *sliver*. This sliver is then passed through another



Courtesy International Harvester Co., Inc.

MAKING ROPE OF MANILA FIBER

(1) A Manila forest; the Manila plants look like twenty-foot banana palms. (2) Manila fibers come from the celery-like stalk of the abaca. (3) Their length depends on the size of the stalk. (4) On long racks the raw fibers are dried and bleached. (5) Blended with sisal, they are fed to machines which lay the rope (6).

series of breakers which arrange the fibers for spinning.

The fiber is spun or twisted to the right to form yarn, which is wound on bobbins. Yarns are twisted to the left to form a strand, and three or more strands are twisted to the right into the finished product. Three strands twisted to the right form a hawser-laid rope, and four strands form a cable-laid rope. Three hawsers twisted to the left form a cable.

Wire rope is made in much the same way. Steel is generally used for wire rope because of its greater strength and durability, but copper and iron are also used. Wire rope is most frequently employed for ship rigging and hawsers, for derricks, and in the construction of cables for suspension bridges.

ROR'QUAL. The whale is recognized as the largest mammal known to man, and the largest of all whales belong to this genus. The rorquals are whalebone animals with a small dorsal fin and wrinkles on the throat. Their heads are comparatively small and flat; their bodies long and streamlined; their tails narrow, then broadening into flukes. *Finbacks* and *blue whales* belong to this genus, which produces most of today's whale oil. See **WHALE**.

ROSACEAE, *ro za' se e*. See **ROSE**.

RO'SARY. Part of the ritual of the Roman Catholic Church is the rosary, fifteen groups or series of prayers, each series consisting of a Paternoster (Lord's Prayer), ten Aves (salutes to the Virgin Mary), and a Gloria. The string of beads used in counting the prayers is also called a rosary. It is symbolic, for the large beads stand for Paternosters (Our Father's) and Glorias, and the small beads for Aves (Hail Mary's), while the crucifix on the pendant symbolizes the Apostles' Creed. The groups of beads are "decades"; generally only five decades are said at one time. Instead of a large bead at the end and at the beginning of each decade, only one bead is used to represent the Gloria and the Paternoster. During the telling of the beads in each decade, the worshiper meditates on one of



A UNIVERSAL FAVORITE

Flower lovers unite in affection for the rose.

the fifteen mysteries of the life and death of Christ.

In the Greek Church, the monks, and not the lay members of the congregation, recite their prayers with the rosary, which is composed of a hundred beads of equal size. In the Russian Church, the rosary consists of 103 beads which are divided into groups by four larger ones, representing the Evangelists. Rosaries are also used by Buddhists and Mohammedans.

ROSE. In romantic fiction and equally romantic history, the rose has been the world's favorite flower. It has ever been a symbol of love and once was an emblem of war. Its beauty and fragrance are recognized wherever it grows, and, whether wild or cultivated, it leads all other flowers in the affections of men and women.

But the rose is not only a flower for poets. It is an important flower to the botanist as well, for its family, the *Rosaceae*, is one of the largest in the world of plants, containing such members as the apple, pear, and cherry, the strawberry and raspberry, and the hawthorn and mountain ash.

In the rose genus itself there are many species and varieties, ranging in size from small rock-garden plants to porch-climbing vines, in color from white to deep red, and including both five-petal and ten-petal blossoms.

soms. The stems of rose bushes or vines are usually covered with thorns, and the leaves are in reality rough-edged leaflets. The fruit is a swollen enlargement of the flower stalk.

Among the numerous cultivated roses are: the *cabbage* rose, with large white or pink flowers; the pink *damask* rose, cultivated in Asia Minor for attar of roses, a perfume; the hybrid *tea* roses, of which the *American Beauty* is a variety; the *ramblers*, species that entwine themselves around supports, The *sweetbriers*, or wild varieties, include the white *Cherokee rose*, the national flower of Iran and the state flower of Georgia. The wild rose is the flower of Iowa, New York, North Dakota, and Alberta. The red rose is England's national flower, and the District of Columbia has chosen the American Beauty.

Portland, Ore., is often called the "Rose City," as are several other cities. Pasadena, Calif., is famous for its New Year's Day Tournament of Roses and for its "Rose Bowl" stadium.

ROSECRANS, *ro' ze krans*, WILLIAM STARKE (1819-1898). A Union officer during the Civil War, Rosecrans graduated from West Point in 1842 and served there as an assistant professor until 1847. Although he had resigned from the army in 1854 to engage in engineering, he volunteered for service under McClellan when the war broke out. He was later made a brigadier general and placed in command of the Union forces in West Virginia. In 1862 Rosecrans took over the command of the army in Mississippi, and successfully defended the city of Corinth against the attacks of Price and Van Dorn.

Rosecrans routed the Confederate forces under Bragg at Murfreesboro, but in a later battle at Chickamauga, he was badly defeated because of an error in an order he had given. He was relieved of his command, but was later placed in command in Missouri. In 1865 he was raised to the rank of brevet major general. Rosecrans resigned from the army after the war, but in 1889 was again commissioned as a briga-

dier general by a special act of Congress and was retired with that rank.

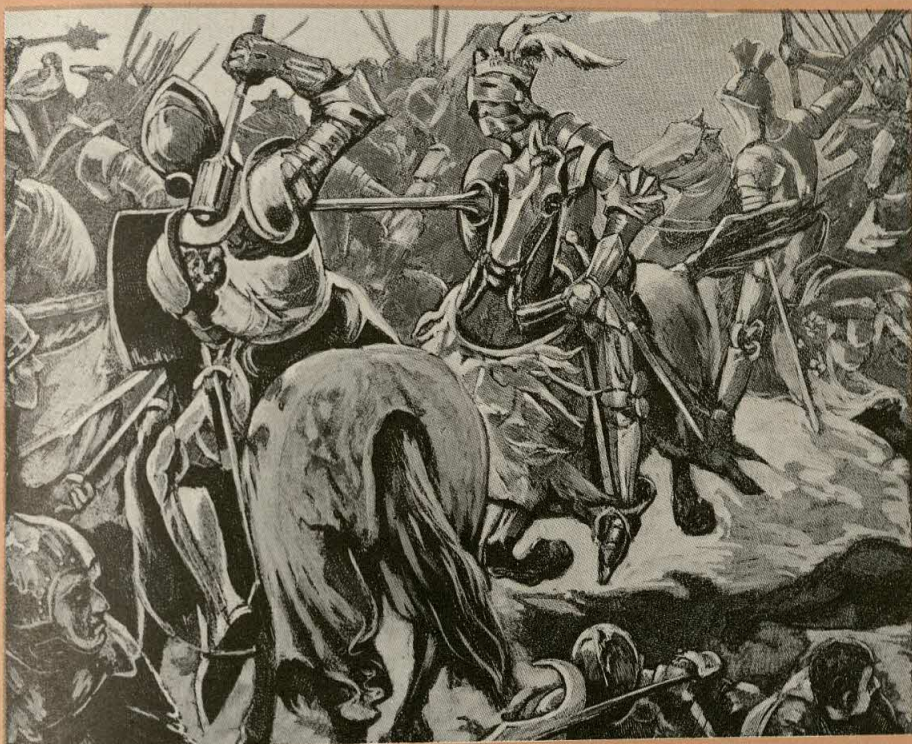
ROSEMARY. Growing wild throughout the limy soils of the Mediterranean region, the rosemary, an evergreen of the mint family, is an attractive bushy plant with leaves dark green on top and whitish underneath, and clusters of small pale-blue flowers. In ancient times the plant was believed to have memory-strengthening power and was the symbol of fidelity and remembrance.

Oil of rosemary, similar to camphor, is the most important product of the shrub. It enters into the manufacture of perfumes, soaps, lotions, and liniments. The leaves sometimes serve as seasoning for sauces.

ROSE OF JERICHO. See JERICHO ROSE.

ROSES, WARS OF THE. A struggle for the possession of the English throne, the Wars of the Roses marked a thirty-year conflict between two great English families, the House of Lancaster, whose emblem was the red rose, and the House of York, whose emblem was the white rose. The struggle opened with the Battle of Saint Albans in 1455 and ended with the Battle of Bosworth, or Bosworth Field, in 1485.

When the Wars of the Roses began, Henry VI of the House of Lancaster occupied the throne, but he was deposed, then reinstated, and finally deposed again. In 1461 Edward IV of the House of York succeeded to the throne, and the deposed Henry VI was imprisoned in the Tower, from which the Earl of Warwick rescued him in 1470, reinstating him. The following year, however, Edward IV regained the throne and held it until his death in 1483. He was succeeded by his thirteen-year-old son, Edward V, but the Duke of Gloucester, the boy's uncle, imprisoned the young prince and his brother, and, it is believed, had them murdered. He then took the throne as Richard III. In 1485 Henry Tudor of the House of Lancaster drove Richard from the throne by defeating him at Bosworth, and was crowned as Henry VII. He married Elizabeth, daughter of Edward IV, uniting the houses.



WAR FOR THE THRONE OF ENGLAND

The Yorkists destroyed the Lancastrian forces at the Battle of Tewkesbury.

ROSETTA STONE. Supplying a key by means of which ancient Egyptian hieroglyphics can be translated, the Rosetta Stone, a black basalt stone found in 1799 near Rosetta, Egypt, by a French officer, contains inscriptions in Greek, demotic (a form of Egyptian writing), and Egyptian hieroglyphics. The inscriptions on the stone honor Ptolemy V. By comparing the hieroglyphics with the Greek, scientists were able to translate the writing and thus formed an alphabet which enabled them to translate other hieroglyphics as well. The stone is now in the British Museum, London. See **HIEROGLYPHICS**.

ROSE WINDOW. Formed of beautiful and delicately colored glass, the rose window is much used in church architecture. It is usually located in the triangular space where the main gables of the roof join, and is a circular window divided into several

equal divisions by mullions and tracery which radiate from the center. It is also called a *Catherine wheel* or *marigold window*, depending on the style. The rose window was commonly used in architecture in the thirteenth and fourteenth centuries. The most exquisite windows were built for the great cathedrals at Amiens and Reims, and for Notre Dame in Paris. See **CATHEDRAL**.

ROSEWOOD. For more than 300 years, rosewood, particularly that from Brazil, has been an important item of foreign commerce. This wood is extensively used for fine pieces of furniture and musical instruments. The best of it comes from the heart of old trees, and has a dark, purplish color. When polished, rosewood is almost black. It is chiefly obtained from Brazil, Africa, and the East Indies. The odor, not unlike that of roses, suggested the name.

ROSIN, *roz'in*. Most common of the resinous products of pine trees, rosin is prepared by distilling turpentine. It remains in a solid mass in the distilling tank after the oil of turpentine has passed off. Rosin is brittle and tasteless, has a pinelike odor, and ranges in color from dark brown to nearly white. It is usually yellowish-brown. Rosin is used in soldering, in the manufacture of varnishes, soap, cement, and sealing wax, in treating violin bows, and for preventing the slipping of machinery belts. See **RESINS**; **TURPENTINE**.

ROSS, BETSY (1752-1836). Wherever the American flag flies, the name of Betsy Ross lives, for she was the maker of the nation's original emblem. She was a seamstress of Philadelphia, and was commissioned by a committee, headed by General George Washington, to make the flag in June, 1777. Mrs. Ross's flag, containing the thirteen red and white stripes and the blue square with thirteen stars in a circle, met with instant approval, and she was given the contract to make all flags for the government. Her daughter continued the work after her death. Mrs. Ross's home at 239 Arch Street is preserved as a memorial.

ROSS, JAMES CLARK, Sir (1800-1862). A daring British Arctic and Antarctic explorer, Sir James Clark Ross contributed much to the scientific knowledge of the Polar regions in the nineteenth century. Born in London, Ross entered the English navy at the age of twelve, and later accompanied his uncle, Sir John Ross, on two voyages in search of the Northwest Passage, and also served with Captain William Parry on four Arctic expeditions. For his work in determining the position of the north magnetic pole, he was made a post captain in 1834, and between 1839 and 1843, he commanded the voyages of the *Erebus* and *Terror* to the Antarctic, where he discovered Victoria Land and many islands. He had gone farther south on this trip than any other man (78° 10' S.), a record that was not broken until 1900.

In 1848 Sir James led an unsuccessful expedition to find Sir John Franklin, lost in



PRE-RAPHAELITE PAINTING

The Beloved, by Dante Gabriel Rossetti, illustrates the Bride in the *Song of Solomon*.

Baffin Land. In that year the Royal Society elected him to membership, and in 1856 he became a rear admiral in the English navy. See **NORTH POLAR EXPLORATION**; **SOUTH POLAR EXPLORATION**.

ROSSETTI, DANTE GABRIEL (1828-1882). Achieving great distinction both as a poet and a painter, Dante Gabriel Rossetti was one of the leading figures of the nineteenth century in England. Born in London, the artist was the son of an Italian refugee who had taken a teaching post at Oxford. The young Rossetti showed considerable talent for painting and studied at the Royal Academy and later under Ford Madox Brown. Rossetti later became the leader of a small artistic circle called the Pre-Raphaelite Brotherhood, a group which believed that painting should return

to the simplicity and purity of the old masters. Most of Rossetti's paintings were exhibited after his death. Among them are his *Girlhood of Mary Virgin*, *Dante's Dream*, *Salutation of Beatrice*, *Beata Beatrix*, *The Blessed Damozel*, and *Fiammetta*.

As a writer, Rossetti combined simplicity and a deep religious feeling in poems of rare beauty. His most famous poem is *The Blessed Damozel*. Christina Georgina Rossetti, the artist's sister, also achieved eminence as a poet, many critics ranking her next to Elizabeth Barrett Browning.

ROSSINI, *rohs se' ne*, GIOACHINO ANTONIO (1792-1868). An Italian composer whose sparkling, lyrical music won him great popularity in his own day, Rossini is best known today for his operas *Otello*, *The Barber of Seville*, and *William Tell*, and his famous hymn *Stabat Mater*. His operas also include *Tancredi*, *Semiramide*, *Moses in Egypt*, and *The Lady of the Lake*. Rossini was born in Pesaro and devoted most of his life to composing, but his greatest works were finished by the time he was thirty. As he grew older, the composer's popularity waned, and he died in comparative obscurity.

ROTHSCHILD, *rote' shilt*, or *roths' child*. For more than a century and a half, this Jewish family managed one of the world's largest banking houses. **Mayer Anselm Rothschild** (1743-1812), first of the famous family, was born in Frankfurt-on-the-Main. He managed the fortune of the elector of Hesse-Cassel, and his sons, as bankers, received the patronage of the elector. The five sons of Mayer Anselm were made barons by the emperor of Austria. They established banks in five of the major European cities, with agencies in Europe and America.

The grandson of the first Rothschild, **Lionel Nathan Rothschild** (1808-1879), born in London, became head of the bank in that city. He was several times elected to Parliament, but was unable to take his seat until the fourth time because he refused to take the oath, which read, "on the

true faith of a Christian." This phrase was finally eliminated in 1858, and he is credited with securing full civil rights for Jews.

The first Lord Rothschild was **Nathan Mayer Rothschild** (1840-1915). He was a member of Parliament (1865-1885) and was raised to the peerage in 1885.

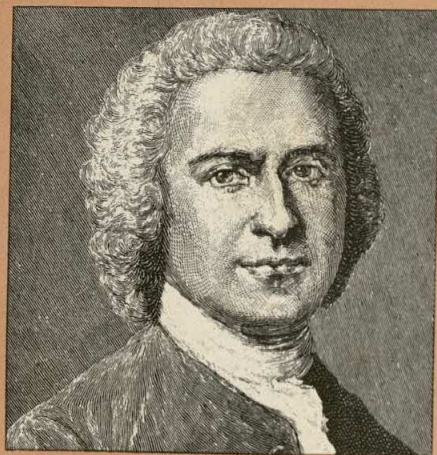
ROUGH RIDERS. Dashing cowboys, organized by Theodore Roosevelt, played a prominent part in the Spanish-American War. These were the "Rough Riders," the First Regiment of United States Volunteer Cavalry, and they were particularly effective in the battles of El Caney and San Juan, Cuba. The members of the Rough Riders formed a patriotic organization in 1899. See ROOSEVELT, THEODORE.

ROUMANIA. See RUMANIA.

ROUND HEADS. Because they wore their hair closely cropped, the members of Oliver Cromwell's Parliamentary army who fought against the English king were dubbed Roundheads by the followers of the king, Charles I. The king's forces were called Cavaliers. See CAVALIERS; CHARLES I.

ROUND TABLE. Romance has woven fanciful tales about the Round Table, around which King Arthur and his knights sat. Each of the seats around the table was reserved for a certain knight, and one, called the Siege Perilous, was reserved for the knight who proved himself worthy to search for the Holy Grail. The honor was finally earned by Sir Galahad. Tennyson's *Idylls of the King* are based on the legends concerning the Round Table. The first mention of the Round Table in English literature is in the *Brut* of Layamon, based in part on the work of the Norman-French poet, Wace. According to this story, the table was round so that no knight would have a preferred position. See ARTHUR, KING; GRAIL, THE HOLY.

ROUSSEAU, *roo so'*, JEAN JACQUES (1712-1778). In any list of the outstanding literary and philosophical figures of the eighteenth century, the name of Jean Jacques Rousseau ranks high. It was not, however, until 1749, when he was thirty-seven, that he began his literary career with a prize-



REVOLUTIONARY WRITER

Rousseau's works inflamed political reformers.

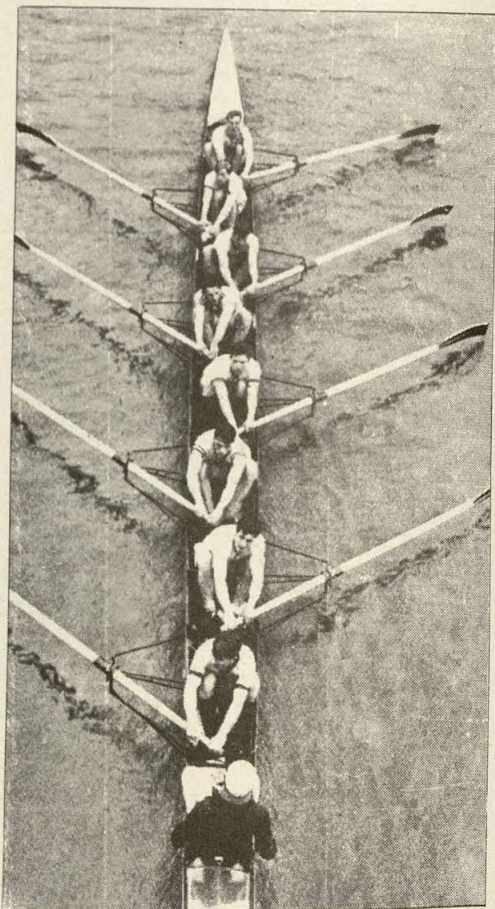
winning essay on the relation between civilization and morals. This was followed by a great number of articles, plays, novels, and serious works dealing with social and political problems. The best known of these are *Discourse on Inequality*, *Émile*, *The Social Contract*, *Julie, or the New Héloïse*, and *Rousseau's Confessions*.

Rousseau expounded the theories that government should be based wholly on the consent of the governed and that education should be a purely natural process, without discipline or a rigidly planned curriculum. In religion he was at variance with both the Catholics and Protestants. He was born in Geneva, Switzerland, of Huguenot refugee parents. When he was sixteen he deserted an apprenticeship as an engraver, traveled to France, was converted to the Catholic faith, and many years later returned to Switzerland, renouncing that faith and once more becoming a Protestant, at least nominally. However, the social ideas contained in *The New Héloïse* and his own mode of living and unconventional morals were not compatible with the orthodox views of the Swiss Protestants.

Mingling with the most intelligent, liberal-thinking groups of his day, he became a mouthpiece for the social and political theories which were crystallizing and

which only a few years after his death were largely responsible for both the American and French Revolutions. The principles set forth in *Émile* have been the foundation of modern methods of teaching.

Because of the views expressed in the *Social Contract* and other writings, Rousseau was forced to leave France, and spent several years in exile in Switzerland, Prussia, and in England. Later, however, he was permitted to return to France, where he spent his last years.



OXFORD WARMING UP

Crew rowing calls for perfect co-ordination.

ROWING, ro'ing. This popular water sport is used by people living near lakes and streams as a means of transportation over short distances. Every hunter and fisherman is obliged to do a considerable

amount of rowing or canoeing in the pursuit of his pastime.

The rowing stroke is not difficult to learn, and one can become fairly efficient after a few trials. The rower sits with his back toward the bow (the front of the boat), his legs extended, his heels pressing against a firm block in the bottom of the boat. Extending his arms forward, he grasps the oar handles firmly, backs of his hands up. He then bends forward from the hips, extending his arms out as far forward as possible, carrying the blades of the oars backward (toward the bow) over the water, being careful not to touch the water.

When he has carried the oars back as far as he can, he allows the entire blades of both to dip into the water. He is now ready for the stroke. He pulls straight back as far as he can, then pushes down on the oar handles to lift the oars out of the water. This movement completes the stroke. The rower is now ready to bend forward and start the next stroke of the series.

Rowing is an ideal exercise for developing the arm, shoulder, back, and leg muscles. Furthermore, it stimulates breathing and develops endurance.

In rowing races between colleges or clubs, very long, light boats called *shells* are used. They are fitted with sliding seats to give greater length of stroke, and are made to seat one, two, four, or eight oarsmen. Great speed is possible in such craft. See CANOE AND CANOEING.

ROYAL CANADIAN MOUNTED POLICE. Under an act of Parliament passed in 1873, the members of the Northwest Mounted Police, now known as the Royal Canadian Mounted Police, were authorized to take over the policing activities of the Canadian Northwest after the Hudson's Bay Company had ceded this vast area to the Dominion. Sir John Alexander Macdonald, first Premier of the Dominion of Canada, had much to do with working out the plans. It was his idea that there should be "as little gold lace and fuss and feathers as possible." The qualifications



BIGGEST BEAT IN THE WORLD

The "beat" of the Canadian "mounty" may cover a vast area of wilderness territory.

for membership were strict, and provided that all members must be able and strong-bodied, of good character, able to ride, between eighteen (later, twenty-two) and forty years of age, and able to read and write the English or the French language.

Only the finest men were accepted, and among the members were many university graduates. Such men were called upon to act in almost any emergency, and cowardice and inability to meet a situation were inexcusable.

Duties. The sole police force in the Northwest Territories, the Yukon, and the Canadian Arctic, the "mounties" not only maintain law and order, but also generally befriend the inhabitants — whites, Indians, and Eskimos. Besides checking on conditions, they deliver mail to remote settlements, fight forest fires, and even act as judges, nurses, and doctors.

Since 1920, when the national police

force was joined to the organization, "mounties" may be called upon to work anywhere in Canada. Since 1928, the police of the various provinces have also been absorbed by the organization, whose headquarters are at Ottawa.

The force's other duties include protecting the nation's government buildings and dockyards, suppressing the drug traffic and smuggling, and carrying on counter-subversive work.

Members enlist for five years, but many re-enlist. They are trained at Regina, Sask., and at Rockcliffe, Ont. The force, comprising nearly 4,000 men in active service, uses horses, airplanes, automobiles, trucks, motorcycles, dog-sleds, and small craft.

ROYAL SOCIETY, THE. One of the oldest and most famous of scientific societies is the Royal Society of London for Improving Natural Knowledge, known generally as the Royal Society. It was officially founded in 1660 by a group of scholars who had been meeting for lectures and discussion for many years. The Society received a charter of incorporation in 1662. It has carried out many projects for the British government, among them being the correction of the calendar in 1752; the measurement of a degree of latitude; several Antarctic and Arctic expeditions; the making of an accurate set of equivalents between the metric and British systems of weights and measures; and studies of tropical diseases.

The Royal Society is located in London. Its publication, *Philosophical Transactions*, which is a valuable record of scientific achievement, was first issued in 1664 and has appeared annually since 1750. The members are known as Fellows of the Royal Society. Originally, only fifteen new members were admitted each year; the number was later increased to seventeen, and in 1937 was again increased to twenty. Distinguished scientists of other nations may be admitted to membership to the number of fifty. Medals are awarded.

RUBAIYAT, *roo'bi yaht*. See OMAR KHAYYAM.

RUBBER AND RUBBER MANUFACTURE. Bouncing balls and telephone apparatus, pencil erasers and hot-water bottles, raincoats, elastic bands, and automobile tires—these are but a few of the numerous and varied rubber products that are so essential to modern living. In the home, the school, and the office, while traveling, and while communicating with our friends, we of the twentieth century are greatly dependent on this valuable substance.

The manufacture of rubber and rubber goods is one of the giant industries of the United States, which makes and consumes more rubber products than any other country on earth. Although other cities have big rubber factories, Akron, Ohio, is the world's greatest rubber-manufacturing center. Despite the tons of rubber used in making countless articles each year, about 85 per cent of that consumed in the United States is in the form of tires, tubes, and parts for automobiles and other motor vehicles.

Most of the world's natural-rubber supply comes from the hevea tree. In the Amazon jungles the trees grow wild, although there are many rubber plantations. In Malaya, Indonesia, Ceylon, Siam, North Borneo, Indo-China, and Liberia these trees are grown on plantations; most of the world's natural-rubber supply now comes from these plantations. At one time, however, Brazil was the greatest rubber-producing country. Wild rubber is also grown in Africa, Central America, and Mexico.

Extraction and Preparation. Rubber is obtained by extracting a milky juice, called latex, from the inner bark of the trees. This liquid is permitted to flow into small containers, and the contents are later collected and poured into large containers. In the Amazon region the natives prepare raw rubber by dipping a wooden paddle into the latex and holding it in the smoke of a fire to evaporate the water. When the evaporation on a paddle is complete, a thin coating of rubber is left. The paddle is dipped into the latex again, and the process



U.S. Rubber Co.; C.I.A.A. Photo

RUBBER IN THE RAW

Left, collecting latex from a rubber tree.
Above, smoking a ball of raw rubber.

is continued. Finally a large ball of raw rubber is on the paddle. This ball, called the "biscuit" or "ham," is then shipped.

On the plantations of the East and in Liberia, however, the rubber is prepared differently for shipping. There the latex is poured into large vessels. Acid is added to coagulate the rubber, which then rises to the surface in the form of a slab. The slab is removed and is run through rollers to form a sheet and to remove any liquid which may have remained. Now the sheets are hung up to dry thoroughly. They are dried in the air or are smoked in a smoke-house for about two weeks.

A more recent development is the spraying process. Latex is shipped to the United States in tank ships and is transferred to tank cars for shipment to the factory. Upon arrival at the factory, it is put into a tank and allowed to drip onto a revolving disc in a heated spraying room. The disc throws off the latex in a spray, and the heat evaporates the liquid; the rubber particles then sift down into trays.

In the factory, rubber is first washed and broken into strips by toothed rollers. After being cleansed and dried, the strips are mixed with sulphur, carbon black, zinc

oxide, and other substances required for the various purposes. Old rubber is sometimes mixed with the new at this stage of manufacture. Since rubber is never melted, all solid rubber articles are molded, not poured. Rubber shoes, clothing, tires, tubes, etc., are made by combining rubber with fabric and heating it in a mold. By pressing soft rubber through an opening die, rubber tubing is made. Common rubber bands are manufactured from pure rubber tubing.

It is also possible to use the latex itself directly in the manufacture of some articles.

History. The use of rubber commercially was speeded up and expanded when, in 1839, Charles Goodyear, an American, invented the process known as vulcanizing (see GOODYEAR, CHARLES). Before this discovery, articles made with rubber became sticky in hot weather and rotted in any weather. Essentially, vulcanization is the process of heating rubber with sulphur.

Rubber first came to the notice of white men when the Spaniards observed the Indians of Mexico playing games with balls that bounced when they struck the ground. Later the Indians in South America were found using shoes made from rubber. The



Good Year Photo

AND OUT POPS A TIRE!

The rubber tire, just being removed from a mold, will be used on the wheel of a tractor.

English chemist Priestley became much interested in rubber in 1770. He was the first to discover that rubber would erase pencil marks; and it was this use which gave the substance its name—it could “rub” away. The English called it India rubber.

Attempts to produce rubber-bearing plants in the United States have been carried on. The guayule shrub, a source of rubber, has been grown in the Southwest, but not extensively, for the plant must be cut down to obtain its latex. Unlike the hevea tree, it cannot be tapped again and again. Scientists have also experimented with milkweed, goldenrod, dandelions, and other plants that contain small amounts of latex, but the source of nearly all the world's natural rubber continues to be the hevea tree.

Synthetic Rubber. Scientists in various countries have also tried to make rubber exactly like that from the hevea tree. So far, however, their test-tube products have been only imitations, or substitutes. Thus

none is a true *synthetic*, although that name is generally applied to the laboratory-made products.

The world's first synthetic-rubber plant was set up in Germany during World War I, when that country was cut off from its natural-rubber sources. Before World War II stopped the flow of raw natural rubber from the Far East, a few large chemical, petroleum, and rubber companies in the United States were producing substitute rubbers of several types. Among these were *Buna-S*, *Buna-N*, *Neoprene*, *Butyl*, and *Thiokol*. It was not, however, until the Federal Government built plants for making synthetic rubber and started production in 1940 that manufacture began on a large scale. The type chosen by the government as being best suited to its war-time needs was *Buna-S*, or *GR-S*, whose basic ingredients are obtained from petroleum, as are those of most of the other substitute rubbers.

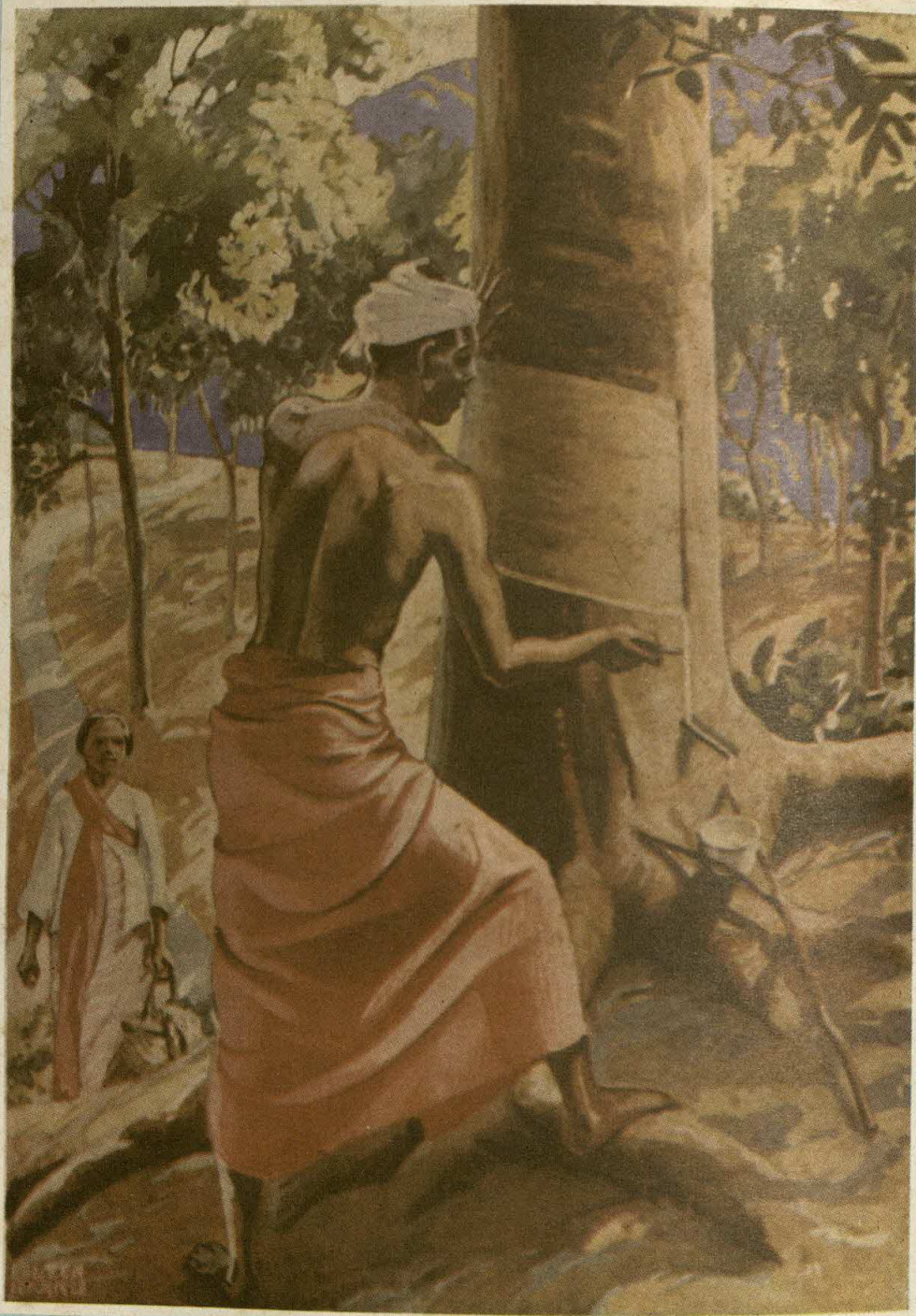
Some of these man-made products have



Goodyear Rubber Co.

THE FIRST PRACTICAL RUBBER BAND

Charles Goodyear discovered by accident the process of vulcanizing rubber. He dropped sulfur and rubber onto a hot stove.



TREE "MILK" FOR AUTOMOBILE TIRES

The milky juice, or *latex*, from the bark of the rubber tree, contains sticky, elastic rubber. Growers have found ways of extracting it without damaging the trees. The tapper starts with a little groove running a third of the way around the trunk. As it runs dry, the cut is enlarged downward. By the time this has been done on the other two thirds, the original cut will have restored itself.

proved superior to natural rubber in resistance to heat, oil, and abrasion. By 1950, synthetic-rubber factories in the United States were producing over a million long tons yearly, and some two thirds of all the rubber used there was synthetic. Canada, the second-largest producer, also was making so much synthetic rubber that it, too, could, if necessary, get along without importing natural rubber. Although natural rubber was still considered best for use in certain parts of heavy-duty tires, golf balls, and a few other products, most rubber goods could be made as well or better from substitute materials.

RUBENS, PETER PAUL (1577-1640). A versatile artist who painted genre scenes, landscapes, portraits, and sacred subjects as well as great historical panoramas, Peter Paul Rubens was a master of the Flemish School. He approached the style of the Italian Renaissance painters in his brilliant use of color, although his work was somewhat lacking in the softness that marked Italian painting. Among his best works are *The Descent from the Cross*, *The Crucifixion*, *Emperor Maximilian I*, and *Children with Fruit Garland*. Rubens was a diplomat as well as an artist, and spent much time at the Italian, Spanish, and English courts.

Born in the German town of Siegen, Westphalia, Rubens was early taken to Antwerp, where the boy studied painting until he was admitted to the painter's guild as a master in 1598. Two years later he went to Italy to study the work of the Renaissance masters, and while there entered the service of the Duke of Mantua. He also went to Spain, where he painted many members of the nobility.

In 1608 the artist returned to Antwerp to become the court painter to Archduke Albert. His fame grew rapidly and he was later knighted by Charles I of England and Philip IV of Spain. His great reputation took him to Paris in 1622 at the request of the queen mother, Maria de' Medici, where he decorated one of the galleries of the Luxembourg Palace.



MASTER OF THE FLEMISH SCHOOL

Above, a section of *The Descent from the Cross*, a Rubens masterpiece now in the Antwerp Cathedral. Below, Peter Paul Rubens as painted by the versatile artist himself.

RU'BICON. Flowing into the Adriatic Sea in Northern Italy is a small stream which looms large in history. This is the Rubicon (now called Fiumicino), which Julius Caesar crossed in 49 B.C., thus defying the government and starting on the path to supreme rule over a great nation. This decisive step on Caesar's part, from which there was no retreat, is symbolized in the phrase used to describe any hazardous undertaking—"to cross the Rubicon."

RUBID'IUM. Discovered in 1861 with the aid of the spectroscope, rubidium is a very light metallic element about six tenths as heavy as aluminum. It bursts into flame when exposed to air, and melts at a temperature of about 100°F., scarcely greater than that of the human body. It is present in nearly all iron ores, and in sea water, seaweed, beets, tobacco, oak, and beech ashes. Rubidium is used in the construction of photoelectric cells. Its symbol is *Rb*.

RUBINSTEIN, *roo'bin stine*, ANTON GRIGOROVITCH (1829-1894). Recognized as one of the most brilliant concert pianists the world has ever produced, Anton Rubinstein, a great Russian musician, also achieved considerable fame as a composer. His operas, symphonies, and oratorios, although they contain much exquisite beauty, are seldom performed today, but his chamber music and piano concertos are widely known and played.

A Russian Jew, Rubenstein received his first training in Moscow, where he made his debut at the age of nine. He appeared in many halls of Europe and studied in Vienna and Berlin. Returning to Russia, he settled in Saint Petersburg (now Leningrad), was the court pianist and imperial concert director, and founded the famous Saint Petersburg Conservatory of Music, which he twice directed. As on all his tours abroad, he was enthusiastically received by audiences in the United States in 1872-73.

RUBLE, or ROUBLE, *roo' b'l*. The monetary unit of Czarist and of Soviet Russia, the ruble is now issued in treasury notes, or paper money, in denominations

of one, three, and five rubles; also in one-ruble silver coins. The ruble equals 100 kopecks. Under the czars, the ruble was worth about fifty-one cents in United States or Canadian money. Placed on a gold basis in 1950, it was so revalued that four rubles equaled one dollar.

RUBY, or RED SAPPHIRE. Of all precious stones, a perfect specimen of the *Oriental*, or *true*, ruby is the most valuable. This stone, of corundum, is extremely hard, deep red in color, and worth many times the price of a diamond of equal size. It is found principally in Siam, Burma, and Ceylon, though some stones have been discovered in Macon County, N. C. The most desired color in rubies is described as *pigeon's blood*. These rubies are found in Burma.

The *spinel* ruby, a stone of less hardness and value, and not a true ruby, is formed of magnesia and alumina. The ruby is the birthstone for July. See PRECIOUS STONES.

RUFF. One of the most peculiar of the sandpipers is the ruff, a bird about twelve inches long, with a coat of brown and white wings and breast. During the breeding season, a circle of long feathers appears around the neck of the male, forming a sort of ruff and giving the bird an "over-stuffed" appearance. At this season the male is very quarrelsome. The females, called *reeves*, are of a more subdued coloring and do not possess the neck ruff.

RUGS. See FLOOR COVERING.

RUMA'NIA. A strategic position for commerce, rich soil, and great mineral wealth give Rumania great natural advantages. Lying north of the Balkan Peninsula in Southeastern Europe, Rumania straddles the chief north-south routes of travel between Northern Europe and the Mediterranean and also the main east-west lines of trade. The country also has access to the Danube River, the greatest commercial waterway in Europe. Yet in spite of its natural advantages, Rumania is not one of Europe's great powers. Losses of territory resulting from World War II have reduced its area to 91,347 square miles.



LONG A LAND OF TROUBLE

At the right is a location map of Rumania. The oil and grain of Rumania reach the Black Sea by way of ancient Constanta, above.

Land and Waters. Rumania is bounded the east by the Black Sea and Soviet Russia, on the north by Soviet Russia, on the west by Hungary and Yugoslavia, and on the south by Bulgaria. The Danube forms part of its Yugoslav and most of its Bulgarian borders, then flows across Rumanian territory for some 190 miles before reaching the Black Sea through several delta-forming mouths.

The Carpathian Mountains extend downward from the north to about the center of the country. Then they turn westward and merge with the Transylvania Alps, which run southwestward to the Iron Gate, where the Danube cuts through the mountains. These ranges separate the high, fertile Transylvanian plateau of northern and western Rumania from the rich plain bordering the Danube and its tributaries in the south and east. Taken together, these rolling, well-watered areas give the country more good farming land than any other Balkan nation.

Rumania's numerous rivers, especially



the Danube, are extensively used in "rafting" logs and as avenues of travel and trade. Because such Danubian ports as Braila and Galati are usually ice-bound in winter, Constanta on the Black Sea is the nation's chief port. Caviar is one of the products of the fisheries along the coast and in the Danube Delta.



RURAL ROMANIAN LIFE

Left, peasant women returning to their village after selling their fresh produce in the city market. Right, big-sailed windmills furnish the power to mill flour in Eastern Rumania.

Climate. Rumania's climate is healthful, but is subject to extremes of temperatures. Its summers are very hot; its winters, long and severe.

Natural Resources. The country has Europe's richest oil fields, the largest being around Ploesti, whose refineries were bitterly fought over and severely bombed during World War II. Rumania also produces large quantities of natural gas and salt. Its other important minerals include lignite, iron, copper, lead, gold, and silver. The pine, oak, and beech forests covering about a fourth of the country form the basis for its valuable lumber and wood-products manufacturing industries.

Farming. About four fifths of the people are farmers. One of Europe's greatest granaries, Rumania produces abundant corn, wheat, barley, rice, and other cereals. Its other crops include potatoes, sugar beets, sunflower seeds (for oil), hemp, flax, tobacco, and cotton. Its vineyards raise the grapes for its famous wines; its orchards yield nuts and fruits. Large numbers of horses, cattle, sheep, hogs, and poultry

also are raised, as are silkworms and bees.

Industry and Transportation. Although its industrialization has only begun, Rumania's industries include oil and sugar refining, grain milling, brewing, distilling, and leather tanning. Among its manufactures are textiles, chemicals, steel, and iron products. After going Communist in 1948, the country nationalized most of its resources and industries, distributed more land among its peasants, and carried out various other typically Communist programs. It also began trading almost exclusively with the other Communist countries.

The Black Sea, the Danube, and airlines connect the country with foreign nations. Rumania also has a fairly good network of railways and roads, as well as pipe lines for transporting petroleum from its oil fields to Constanta for export.

The People. Most of the country's 19,000,000 people are native Rumanians, who are a mixture of the Slavs, Mongols, Teutons, ancient Romans, and others who have lived there throughout the centuries. Among its various other population groups are numerous Gypsies. Rumanian is similar to the Italian language. The illiteracy rate is still high, but elementary education is free and compulsory. There are universities at Bucharest (the capital),

Jassy, Cluj, and Timisoara. Most of the people belong to the Rumanian Orthodox Church. All religions are state-controlled.

History. Much of Rumania was the ancient Roman province of Dacia. As the medieval principalities of Moldavia and Walachia, the region was ruled by the Turks and then by the Russians. The two states united in 1859, took the name Rumania, and became a kingdom in 1881. Joining the Allies in World War I, it was doubled in size by the peace treaty.

King Carol II was forced to abdicate in 1940. His son, Michael, became king, but the country was actually ruled by the premier, General Ion Antonescu, who took Rumania into World War II on the side of the Axis. Russian forces conquered the country in 1944. In 1947 the Communist Rumanian People's Republic was proclaimed. See BUCHAREST; DANUBE; WORLD WAR (I, II).

RUMINANTS, *roo'min ants*. Animals that chew their cuds, like the cow, sheep, goat, and deer, are ruminants. They have much larger stomachs, and in many ways more peculiar stomachs, than other animals. They all eat vegetable food and take their food in large quantities.

Typical ruminants have four-chambered stomachs. When they first take in their food they do not chew it thoroughly, but store it in the *paunch*, or first compartment of the stomach. After they have eaten their fill, they return this food to the mouth little by little for a second chewing. This twice-chewed food now passes back into the second compartment, or *reticulum*. Here, the liquid portion is retained, and here, also, any foreign substances, such as stones and dirt, are deposited.

Then the solid food passes into the third compartment, or *omasum*, where it is ground still finer by sandpaper-like structures. It then passes into the fourth compartment, or *abomasum*, where it is mixed with the gastric juices for digestion. Finally, the food passes into the intestine.

Ruminants all have hoofs and therefore belong to the ungulates (see UNGULATES).

The following ruminants are described elsewhere in these volumes:

Antelope	Giraffe
Camel	Goat
Caribou	Llama
Cattle	Moose
Chamois	Musk Ox
Deer	Pronghorn
Elk	Sheep

RUMP PARLIAMENT. When Cromwell's soldiers, led by Colonel Pride, expelled all of the members of the Long Parliament except the Independents in 1648, the remaining members, sixty in number, were called the Rump Parliament. This body was dissolved by Cromwell in 1653 for opposing the army's demands, but was reinstated later. In March, 1660, it was dissolved by its own decree.

RUNES, *roonz*. The ancestors of modern North Europeans wrote in runes, characters composed of vertical and slanting straight lines and a very few curved lines. This type of writing was probably first used by heathen priests in religious rites, and their writings were secret in meaning. In fact, the term is derived from the Anglo-Saxon *run*, meaning *mystery*.

Runes are found in inscriptions engraved on monuments, tombstones, and weapons, and there are a few runic manuscripts. The early inhabitants of the British Isles and early Germanic and Scandinavian peoples wrote in runes from about the third century to the fifteenth.

The extension of Christianity put an end to the use of runic characters, with their pagan associations. The latest inscriptions in Sweden were written about 1450.

RUN'NIMEDE. On June 15, 1215, the feudal barons of King John of England met on the plain of Runnime de and forced the despotic monarch to sign England's manifesto of freedom—the Magna Charta. The field is on the banks of the Thames, four miles below Windsor. See MAGNA CHARTA.

RU'PEE. The monetary unit of what was once British India and of independent India, the rupee is issued in paper notes and in coins. The rupee is divided into

sixteen *annas*. A *lakh* equals 100,000 rupees; a *crore*, 100 lakhs, or 1,000,000 rupees. The *Pakistani rupee*, first circulated in 1948 and Pakistan's unit of money, also is issued in paper notes and in coins. India's rupee is normally worth twenty-one cents in United States or Canadian money, while Pakistan's is worth about thirty and a quarter cents.

RUPERT'S LAND. In 1670 King Charles II of England granted to the newly formed Hudson's Bay Company sole trading rights in all the lands drained by the streams flowing into what is now called Hudson Bay. Named for Prince Rupert, the company's first head, this vast domain of undefined boundaries was practically owned by the company until 1869, when it became the property of Canada. Today, the part that is not included in the provinces belongs to Canada's Northwest Territories, where law and order are maintained by the nation's famous "mounties." Despite its mineral wealth, including uranium, much of this bleak area is still an undeveloped wilderness. See CANADA; HUDSON'S BAY COMPANY; ROYAL CANADIAN MOUNTED POLICE.

RURAL CREDITS. Like other businessmen, farmers sometimes need ready cash to meet emergencies or to finance the expansion of their enterprises. In many cases, this money is raised by credit, which is provided by various agencies, including commercial banks, loan, mortgage, and insurance companies, and private investors. See CREDIT.

In the United States, credit to farmers and stockmen has also been provided by the Federal Government since 1916. Realizing that farm prosperity is vital to the economic health of the nation, Congress in that year enacted the Federal Farm Loan Act. Under this, several organizations were established to provide farmers with long-term credit at low interest rates. Since then, the system has been considerably enlarged and revised from time to time.

Today, the Farm Credit Administration, a branch of the Department of Agriculture,

has charge of the major part of the nation's rural-credit program. Its general purpose is to provide a complete system for making credit available to farmers and farm co-operatives at low cost. For convenience, the FCA divides the country into twelve districts, in each of which it has several banks for handling farm credits.

Oldest of these are the Federal Land Banks, established in 1916. From these, farmers may get long-term amortized loans at low interest rates by giving first mortgages on their land. Under certain limitations, corporations raising livestock also may borrow from them. Loans to any one borrower may not be for less than \$100 nor more than \$100,000. Nor may the amount of the loan exceed 65 per cent of the appraised value of the land put up as security. Such loans are repayable, in annual or semiannual installments, over a period of years, usually from twenty to thirty.

Also administered by the FCA are the Federal Intermediate Credit Banks, which make loans to, or discount paper for, institutions providing rural loans. Among these financial institutions are state and national banks, livestock-loan companies, and banks for co-operatives. Instead of lending directly to borrowers, these intermediate-credit banks assist the financial institutions that lend to them. A note given as security by such a borrower is nearly always due within a year, usually when he has marketed his crops or livestock. In no case is the loan made for more than three years. These intermediate-credit banks were established in 1923.

Other FCA credit organizations include the Production Credit Corporations and Associations, established in 1933 to provide short-term loans to farmers and stockmen. Made for at least \$50, these loans are usually due in less than a year. The Central Bank for Co-operatives, located in Kansas City, Mo., and its branches in the twelve farm-credit districts also were set up in 1933 to help farmers. As their

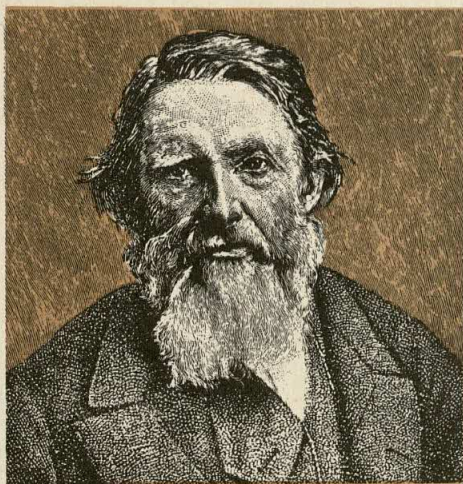
name suggests, they provide credit to enable farmers' co-operatives in purchasing, marketing, and storing their produce and supplies.

The Commodity Credit Corporation, another branch of the Department of Agriculture and also established in 1933, lends money to farmers for use in building and expanding storage space for their produce. Still another important agency is the Farmers Home Administration, which was created in 1946. Also a separate branch of the Department of Agriculture, it provides supervised credit for needed loans not otherwise available. Its offices, which are usually located in county-seat cities, make loans to United States citizens who own, rent, or "sharecrop" family-type farms and devote most of their time to, and earn most of their income from, farming or stock-raising. Such loans are repayable in one to five years, and no borrower may ever be in debt to the FHA for more than \$5,000. Among the many purposes for which these loans are made are the purchase of land, seed, fertilizer, machinery, stock, and feed; payment for medical care; meeting family living needs; and procuring irrigation water.

RUSKIN, JOHN (1819-1900). A famous English art critic, essayist, and social reformer, John Ruskin also wrote *The King of the Golden River*, a classic fairy tale for children. Born in London of wealthy Scottish parents, he had traveled widely and had even begun writing before he entered Oxford University.

In 1843, the year after his graduation, Ruskin published the first volume of his famous *Modern Painters*, of which four more volumes were issued later. This work not only established him as a noted art critic, but also made the public appreciate the work of Joseph Turner and other artists of his day. Also distinguished were Ruskin's *Seven Lamps of Architecture*, *Stories of Venice*, and other works on architecture, in which he defended contemporary artists and writers.

After lecturing and writing on art sub-



HONORED CRITIC AND WRITER

Ruskin's writing career lasted for fifty years.

jects, Ruskin became interested in social problems, advocating a system of national education, the organization of labor, slum clearance, and other reforms for improving the lot of Britain's working men. Besides writing *Unto This Last*, *Sesame and Lilies*, *Crown of Wild Olives*, *Fors Clavigera*, and other works on such subjects, he spent much of his time and money on projects for helping the poor.

RUSSELL SAGE FOUNDATION. In 1907 Mrs. Russell Sage created this foundation as a memorial to her husband (see SAGE, RUSSELL). The original endowment of \$10,000,000, soon increased to \$15,000,000, was to be used for removing the causes of poverty and distress and for improving social and living conditions in the United States. The foundation's activities have included the promotion of recreational, educational, housing, and health-improvement projects for the benefit of the poor, the conducting of social-science research studies, and the providing of loans.

RUSSIA. Occupying eastern Europe and northern Asia, Russia is the world's largest country, covering nearly one sixth of the earth's lands, or 8,708,000 square miles. Living within this vast and varied area are some 210,000,000 people, representing many nationalities and national cultures

and having many differing ways of living.

For centuries, Russia was an absolute monarchy, ruled over by despotic czars, who oppressed the great mass of its peoples, keeping them in ignorance and poverty. Then in 1917 a Bolshevik revolution overthrew its czarist government and opened the way for the establishment of a Communist state, officially called the Union of Soviet Socialist Republics (see UNION OF SOVIET SOCIALIST REPUBLICS). Although the name Russia is now properly applied only to the country as it existed in czarist days, its people are still called Russians.

The Union of Soviet Socialist Republics, whose capital is Moscow, is a federation of the following fifteen republics: the Russian Soviet Federated Socialist Republic (Russia proper, covering about three fourths of the country's total area), the Ukrainian Soviet Socialist Republic (the Ukraine), the Byelorussian S.S.R. (White Russia), the Azerbaidzhan (or Azerbaijan) S.S.R., the Georgian S.S.R., the Armenian S.S.R., the Uzbek S.S.R., the Turkmen S.S.R., the Tadzhik S.S.R., the Kirgiz (or Kirghiz) S.S.R., the Kazakh S.S.R., the Moldavian S.S.R., the Estonian S.S.R., the Latvian S.S.R., and the Lithuanian Soviet Socialist Republic.

RUSSO-FINNISH WARS. World War II had begun, and Poland had already fallen to the eastward-marching Germans. With all the other big European nations at war or occupied with their own problems, Soviet Russia decided that she could easily strengthen her borders by demanding territory from neighboring Finland. Though weak and small, Finland rejected her demands, but tried to work out a compromise. Unwilling to bargain, the Russians attacked Finland by land, sea, and air on November 30, 1939.

Expecting to win easily, the invaders used their second-rate troops and equipment, but soon discovered that the freedom-loving Finns were winning most of the battles. Moreover, several other nations were so incensed by the Russians' ruth-



FIRST RUSSIAN RULER

In the ninth century, Rurik, a Scandinavian sea raider, conquered most of European Russia.

less, unprovoked invasion that they were aiding the Finns. In fact, it looked as though Finland might win until February, 1940, when Russia sent in better troops and launched a powerful offensive. A month later, the "Winter War" was over, and defeated Finland had to agree to Russia's territorial demands.

Both angered and under German pressure, Finland joined Germany in its in-

vasion of Russia in June, 1941, and soon found itself at war with Britain, too. Victorious at first, the Finns regained their lost territory, but were soon made wretched by the Germans who swarmed into their country. When Russia and Britain offered armistice terms in September, 1944, Finland accepted.

Under the final peace terms of 1947, Finland ceded to Russia the Petsamo area, with its ice-free port of that name and its nickel mines, the city of Viipuri (Viborg) and the rest of the Karelian Isthmus, the western and northern shores of Lake Ladoga, and several islands in the Gulf of Finland. It also gave Russia a fifty-year lease on the Porkkala Peninsula for use as a naval base, and agreed to pay the victor an indemnity of \$300,000,000's worth of ships and machinery. In September, 1952, Finland made its last payment to the country that had taken about an eighth of its territory. See FINLAND; UNION OF SOVIET SOCIALIST REPUBLICS.

RUSSO-JAPANESE WAR. Japan's rise to the position of a first-class power began with her victory over Russia in this war of 1904-5. The war was fought because the two nations wanted to dominate the Far East and coveted control of Korea, Manchuria, and the ice-free harbor of Port Arthur at the tip of Liaotung Peninsula.

For one thing, Japan was angry because Russia had joined France and Germany in forcing her to return the peninsula to China in 1895. Russia's leasing of the area from China and her extension of her control over all Manchuria and into Korea also aroused the Japanese to protest.

But before diplomatic negotiations could succeed, Japan made a surprise attack on Port Arthur on February 8, 1904, then continued to besiege the city until the following January 2, when it surrendered. After other victories, Japan defeated the Russians at Mukden, Manchuria, in February, 1905, then completely destroyed their fleet in May.

In June, 1905, President Theodore Roosevelt suggested that the warring na-

tions make peace, and a conference was soon held at Portsmouth, N. H. Under the treaty signed there on September 5, 1905, Manchuria was returned to China and Japan won control of the Liaotung Peninsula and Port Arthur, was given the southern half of Sakhalin Island, and gained virtually complete control over Korea (renamed Chosen). See CHINA; CHOSSEN; JAPAN; MANCHURIA; SAKHALIN.

RUSSO-TURKISH WAR. The Turkish massacre of Christians in Bulgaria was Russia's pretext for starting war on Turkey in 1877. Actually, she hoped to regain some of the power she had lost in the Crimean War of 1854-56. Though very inefficient, the Russians finally captured several cities and began driving toward Constantinople (now Istanbul). The Turks surrendered in 1878 and signed the Treaty of San Stefano, which was very favorable to Russia. Fearing the growth of Russian power in the Balkans, Britain and the other European nations called the Congress of Berlin, stripped Russia of most of her gains, and restored the balance of power.

RUST. If a piece of iron or steel is left exposed to damp air, it soon becomes coated with a scaly reddish-brown substance known as rust. This coating is actually a chemical compound called iron oxide, and is formed by the action of oxygen on iron. It may be removed by rubbing the iron or steel with an abrasive such as emery or carborundum. Iron rust spots can be removed from clothing by treating the fabric with a weak solution of oxalic acid or lemon juice.

RUSTS. Tiny fungi that live on plants and cause untold damage, the rusts get their name from the fact that many of them produce spores resembling iron rust in color. Rusts are especially harmful to cereals, but also damage many other kinds of plants, including trees.

Every species of rust has its own life cycle of from two to five stages. In each stage it produces a different type of spores, from which a different kind of plant grows. Black stem rust, for example, has to have

two hosts—wheat and American barberry plants—to complete its life cycle. At one stage its spores are orange “cluster cups.” At other stages they are reddish-brown “blisters,” blackish, black, or colorless. See FUNGI.

RUTH, BOOK OF. The author of this book of the Old Testament is unknown, but it was written to encourage friendship among the different peoples of ancient Palestine. See BIBLE STORIES.

RUTHE'NIUM. This costly grayish-white metallic chemical element belongs to the platinum group of rare metals. It is used chiefly to add hardness and strength to other metals—in alloys used in making fine jewelry, pen-point and phonograph-needle tips, and electrical contacts for control devices, such as thermostats. It is heavier than lead and will not dissolve in water or acids. Its symbol is *Ru*; its atomic number, 44; its atomic weight, 101.7; its melting point, about 2450°C.

RUTH'ERFORD, ERNEST, Sir (1871-1937). A British physicist, Rutherford was noted for his pioneer work in radioactivity and the structure of the atom. His investigations revealed many facts about the properties and behavior of the particles and rays emitted by radioactive substances. By bombarding nitrogen with alpha particles he made the first change of the atoms of one substance (nitrogen) to the atoms of another (oxygen). Similar experiments by others led later to the production of artificial radioactivity and to the release of atomic energy.

Born near Nelson, New Zealand, Rutherford studied at the University of New Zealand and at Cambridge University in England. He was professor of physics at McGill University, Montreal, in Canada, from 1898 to 1907, then at the University of Manchester, in England, until 1919, when he returned to Cambridge as director of its Cavendish Laboratory. In the following year, he was appointed professor of physics at the Royal Institution, London. He received the Nobel prize for chemistry in 1908, was knighted in 1914,

and in 1931 became the first Baron Rutherford of Nelson. He authored many important works on radioactivity.

RUYSDAEL, or RUISDAEL, roys' dal, JACOB VAN (1628-1682). The foremost Dutch landscape painter, Ruysdael was born in Haarlem, but lived in Amsterdam from 1657 until 1681. His imaginative and beautiful paintings now hang in many of the world's great art galleries. Yet this gifted artist, who excelled in painting waterfalls and forest, shore, and mountain scenes, died in an almshouse at Haarlem.




RYE. In some northern European countries, rye is the chief cereal crop. Believed to be native to the cool areas of western Asia and eastern Europe, it probably was not cultivated until the Middle Ages.

Rye grows taller than wheat and has longer, more heavily bearded flowering spikes. Its stems are slender, but tough, and its spikelets contain only two or three flowers. The bluish cast of its foliage makes it easy to distinguish between a field of rye and one of wheat. Rye is more resistant to diseases and insects than other small grains; also hardier, surviving harsher winters and thriving in poorer soils.

Rye bread is a basic food in Russia, Germany, Poland, Czechoslovakia, and several other European countries. In the United States, Minnesota, the Dakotas, and Nebraska are the leading rye-producing states. The grain is made into whisky and other intoxicating liquors. It is distasteful to farm animals and may even cause digestive disorders unless mixed with other grains. Rye straw is used in thatching and in making bricks, paper, baskets, and hats. Plowed under, rye helps to restore wornout soil.

RYE HOUSE PLOT. In 1683 a few radical English Whigs plotted to assassinate Charles II and to put the Protestant Duke of Monmouth on the throne. The scheme failed when Charles did not pass by Rye House Farm as expected. Lord William Russell and Algernon Sidney were later beheaded for complicity, although their guilt was never proved.



S. To the ancient Phoenicians the letter *S* symbolized teeth; they wrote it , much like our *W*. The Greeks turned it on its side and at first wrote it . But later Greeks, who wrote from left to right, turned the letter around and wrote it . The Romans smoothed and rounded it to the form in which it has come down to us as the nineteenth letter in our alphabet.

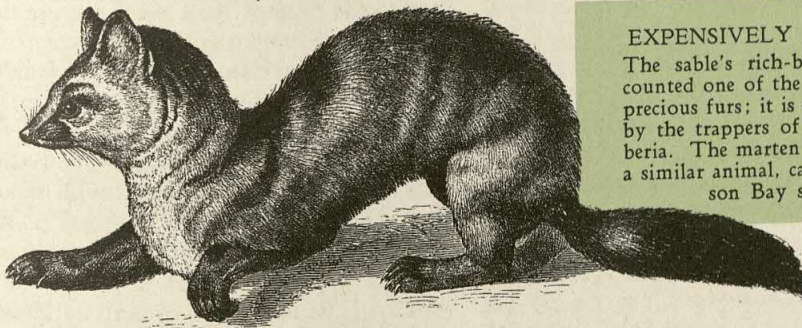
SAAR, *zahr*, VALLEY. This small mining area in Germany, adjoining the French border, is one of the world's richest sources of coal. For this reason it has long been coveted by nations desiring a fuel supply for manufacturing. Following the First World War, the Saar Basin was taken from Germany and administered by the League of Nations. France was permitted to work the mines in compensation for coal taken from French soil by the Germans during the war. In 1935, the people of the Saar voted for reunification with Germany. After World War II, the region was under French rule. France wanted to make it a part of an European Defense Community, but the people voted against it. By treaty in 1957, the Saar became part of the Federal Republic of Germany. Its area is 991 square miles and its population, about 1,400,000.

SAB'BATH. According to the Bible, the seventh day of the week should be set aside for rest and worship. In the Ten Commandments the day is called the Sab-

bath, and it was generally accepted by early Hebrews as the last day of the week—Saturday. The Israelites observed the Sabbath according to a very rigid list of prohibitions. They were not allowed to travel or to do any kind of work.

During the ministry of Jesus this interpretation of the Mosaic Law caused Him to suggest that the Sabbath was made for man and not man for the Sabbath, indicating that good works are quite permissible on that day. The Jews still keep Saturday as the Sabbath, but most Christian bodies have changed it to Sunday, since the gospels teach that the resurrection occurred on the first day of the week. An exception is the Church of the Seventh Day Adventists; this group observes Saturday, the seventh day, as the Sabbath.

SABLE. So valuable is the skin of the sable that a coat made of the fur often is sold at retail for thousands of dollars. The sable is a native of Siberia, and is related to the marten, or American sable. An adult sable is about one and one-half feet long.



EXPENSIVELY CLOTHED

The sable's rich-brown coat is counted one of the world's most precious furs; it is eagerly sought by the trappers of Northern Siberia. The marten of America is a similar animal, called the Hudson Bay sable.

The animal has glossy, brown fur and a bushy tail. Sables live in trees and rock crevices, feed upon squirrels, mice, and nuts, and are very difficult to catch.

SAC, or SAUK. Northern Wisconsin once was the homeland of the Sac Indians, an Algonquian tribe noted for their hatred of white men. They were related to the Foxes, with whom they formed a confederation in 1760, after they had been driven south by the Ojibwa. Black Hawk, the famous chief who caused so much trouble in the first half of the nineteenth century, was a chief of this confederation. The Sacs and Foxes were almost exterminated because of wars, and today only a few remain in Oklahoma and Kansas. See **BLACK HAWK**.

SACCHARIN, *sak'a rin*. Strange as it may seem, the sweetest known substance in the world, saccharin, is a product of ordinary coal tar. It was discovered by Dr. Constantin Fahlberg, of Germany, and Professor Ira Remsen, an American chemist, in 1879. When pure it has a sweetening power 550 times greater than that of cane sugar, and is about 300 times as sweet in its commercial form. A one-half-grain tablet will sweeten a cup of coffee.

Persons suffering from certain diseases may be advised by their physicians to avoid the use of sugar, and in such cases saccharin is often prescribed as a substitute sweetening. For this purpose it is usually compressed into small white tablets. Saccharin does not ferment and has no food value. United States laws prohibit its use in commercially prepared foods, but it is so used in many other countries.

SACRAMENTO, *sak ra men'toh*, CALIF. Once the center of the celebrated gold region that attracted thousands of "forty-niners" to California, Sacramento has grown from a crude mining town to be the capital and one of the largest cities in the state. It is situated on the Sacramento River in the heart of a large and productive agricultural region, for which it serves as chief market and shipping point. It is, in addition, an important center for the manufac-

ture of agricultural products. The leading establishments are meat-packing plants, canneries, flour mills, foundries, machine shops, and factories producing soap, brick and tile, and furniture.

Sacramento is a well-planned city with beautiful parks, wide boulevards, and large buildings. The outstanding structure of the city is the California State Capitol, which is surrounded by a park of thirty-four acres, containing winding walks and gardens with rare plants. Among the well-known institutions of Sacramento are the State Library, Christian Brothers' College, Saint Joseph's Academy, and the Crocker Art Gallery.

Captain John A. Sutter first settled on the site of Sacramento in 1839. In 1841 he built a fort here and named it New Helvetia. The fort is now a museum of historical relics. In 1848 land was purchased for the development of a town, and the name was changed to Sacramento. The city enjoyed rapid growth and great prosperity after the gold rush began. It was made the capital of the state in 1854. The population is about 193,000.

SACRED COLLEGE, or COLLEGE OF CARDINALS. Formed in 1150, the Sacred College, or College of Cardinals, is a corporation composed of cardinals of the Roman Catholic Church. The chief duty of the group is to elect a Pope upon the death of the Holy Father. See **CARDINAL**; **POPE**; **ROMAN CATHOLIC CHURCH**.

SADDUCEES, *sad'u seez*. The political and religious sentiments of Jewish aristocracy at the time of Jesus were represented by the group known as the Sadducees. The Sadducees comprised a loosely organized party whose main interest was to maintain conditions as they were, in support of the rich and powerful of the day. Their chief opponents were the Pharisees, with whom they disagreed on several religious points. The organization of Sadducees became extinct after the destruction of Jerusalem in A. D. 70. The formalism of both Sadducees and Pharisees was rebuked by Jesus (*Matt. XVI*). See **PHARISEES**.



National Safety Council, Inc.

SAFETY. Every hour of every day, accidents that could have been avoided result in an appalling number of deaths and injuries. Expressed in terms of money, their costs in the United States alone is billions of dollars yearly. This staggering loss of life, working time, and property should makes safety "everybody's business."

Oddly enough, more accidents occur in the home than anywhere else. Falls, burns, carelessly handled poisons, escaping gas, and fires are only a few of the causes of the countless accidents that occur there. Failure to exercise care and good judgment in the office or factory may have disastrous results, as may recreational activities that should be both pleasant and beneficial. Swimming, for example, may end in a drowning; hunting in an accidental shooting; skating in a bone fracture; snowballing in a loss of sight, hearing, or even life.

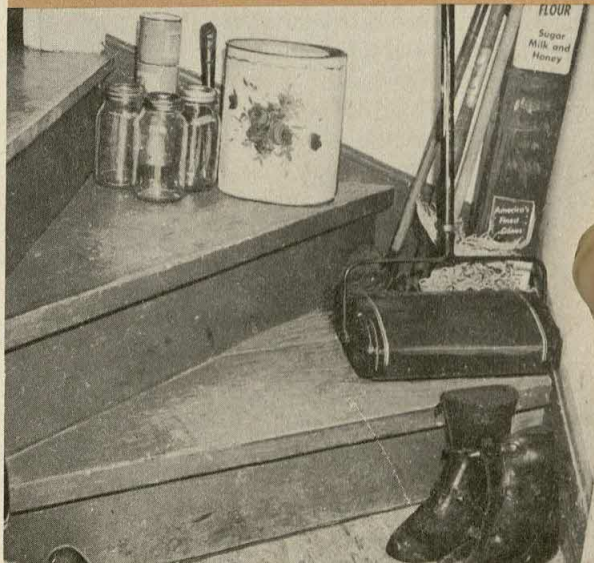
Automobiles are involved in far more accidents than are ships or planes. Among the causes are speeding, skidding, the failure of cars to keep to the road, driv-

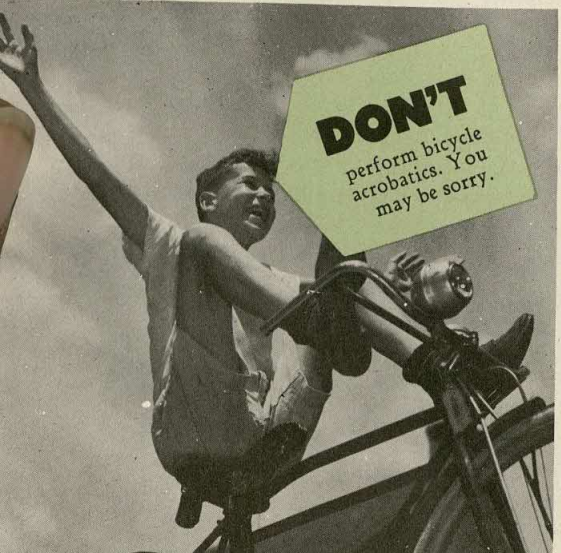
ing on the wrong side of the road, failing to signal, improper passing of other automobiles, and crossing a railroad track when a train is coming.

The campaign against accidents is being led by industries, safety clubs, and civic-minded groups which publicize the accident toll and conduct a general education

INVITATION TO INJURY A cluttered stairway is an accident trap.

National Safety Council, Inc.

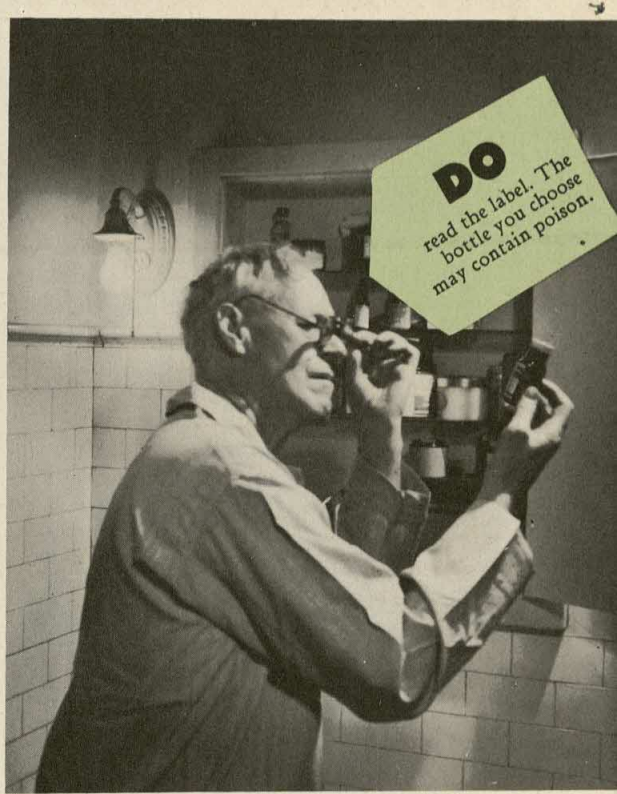




program. Federal, state, and local governments have passed laws ordering certain buildings to be fireproof; requiring automobiles to have good horns, adequate brakes, proper lights, etc.; providing for lighting of exits in buildings; compelling the use of guards for machinery; making it compulsory for boats to be equipped with radio apparatus and lifeboats, and seeing that food conforms to certain standards.

Although the campaign for greater safety is producing results, much more educational and constructive work is needed. To reduce automobile accidents, both motorists and pedestrians must learn to follow the rules of safety and obey traffic laws. More and better highways must be constructed, with proper underpasses and overpasses, with circle and clover-leaf intersections, with parkways separating the lanes of traffic on wide roads, and with good lights to prevent the glare of automobile headlights. Cities also must plan for playgrounds and safe streets. Dangerous grade crossings must be eliminated.

To reduce industrial accidents, which not only cause suffering among the working people, but involve large costs to in-



National Safety Council

dustry in the form of damaged equipment, workmen's compensation, and litigation, more safety devices must be installed for machines, employees must be trained, existing safety laws must be enforced, and, when necessary, new ones passed, especially those regarding chemical industries.

For the reduction of accidents in the home, study groups and classes are necessary to educate parents and children on the proper use of household implements.

Above all, persons everywhere should always be careful, and think before they act.

SAFFRON, *saf'run*. Queen Elizabeth once paid a visit to a town called Saffron Walden, and the corporation, or town government, paid five guineas, or about \$26, for a pound of saffron to present to her. Though this is the highest price on record, saffron, which consists of the dried, orange-colored stigmas and styles of a purple crocus, was very much prized in old England.

"I must have saffron to color the warden pies," says the clown in Shakespeare's *Winter's Tale*, and it was for coloring that saffron was chiefly grown. It was also used

medicinally and for flavoring.

Modern saffron comes largely from the Mediterranean countries. As it requires the stigmas of about 4,000 flowers to make an ounce, it cannot be grown profitably except where labor is no consideration.

SAGE, *sajē*. First among herbs for the kitchen, the sage plant is a native of Southern Europe, and sage from Central Europe, Italy, and France is still considered the best on the market. The plant is shrubby, with whitish-green or red leaves and, in early summer, blue, pink, or white flowers. It thrives in sunny places, in well-drained, rich loam, thoroughly broken up.

Sage leaves, used chiefly in sausages, dressings, and sage cheese, are best when fresh. It is difficult to cure them and at the same time retain the aromatic oil which flavors them. Small quantities of sage are dried by merely hanging the plants in bunches in a light, airy room.

SAGE, RUSSELL (1816-1906). Much of the immense fortune of Russell Sage, outstanding American financier of the last century, was derived from railroad specu-

lation. Sage was born in Oneida County, N. Y., and was reared on a farm. He was a member of Congress from 1853 to 1857, and shortly afterward became associated with Jay Gould in New York. Upon his death, his wife, Margaret Olivia Slocum Sage, received his entire fortune of more than \$50,000,000.

Mrs. Sage (1828-1918) became one of the foremost American philanthropists, establishing the Russell Sage Foundation. At her death, she left most of the remaining estate to specified philanthropic and educational projects. See RUSSELL SAGE FOUNDATION.

SAGE/BRUSH. All over the drier parts of the West are woody kinds of wormwood, all of which go by the general name of sagebrush. Indeed, this name is also given to many other similar-looking desert shrubs. All of the sagebrushes have a pungent odor not unlike that of dog fennel, or mayweed, but stronger. The *common*, or *three-toothed*, sagebrush grows from British Columbia to Montana and southward to California and Colorado, but more or less closely similar kinds are nearly everywhere in the West. Only the shrubby wormwoods are properly classed as sagebrush.

In many of the drier parts of the West, sagebrush is the main fuel that can be had. Cattle and sheep eat sagebrush to some extent, but like some kinds much better than others.

SA'GO. Commonly used in thickening soups and in making puddings and other desserts, sago is a starch derived from the pith of certain palms and cycads, or palm-like plants. It is largely a product of the East Indies. The trees producing the sago store the starch in their trunks just before they bear their flowers. The palms are cut down at flowering time, and the pith is removed, broken up into small pieces, and placed in water, which takes the sago starch from the pith. The sago-filled water is then drawn off and evaporated to leave the starch. This is reduced to a flour, which is worked into a dough by kneading.

Pearl sago, which may be bought at the store, is made by forcing the material through sieves onto hot, greased pans. In the United States, which imports large quantities, sago is used for much the same purposes as cornstarch, tapioca, and arrowroot starch.

SAGUENAY, *sag eh na'*, RIVER. One of the largest and most important tributaries of the Saint Lawrence is the Saguenay River, noted for its scenic beauty. The river system originates near the center of Quebec with a number of streams which flow southward and empty into Lake Saint John. From this lake the Saguenay, 125 miles long, flows southeastward into the Saint Lawrence near its mouth.

Ocean steamers can ascend to Ha Ha Bay, sixty miles above its mouth, and small steamers can ascend to the town of Chicoutimi. Over the lower course the stream varies in width from three-fourths of a mile to two miles. Its sides rise almost perpendicularly, forming a chasm varying from 300 to 1,800 feet in depth. Ha Ha Bay and Tadoussac, near its mouth, are famed as summer resorts.

SAHARA, *sa hah'ra*. The vast Sahara Desert is comprised of about 3,500,000 square miles and is about the size of the Dominion of Canada. It spreads across Northern Africa from the Atlantic to the Red Sea and from the Barbary States to the region of Lake Chad and the Niger River. It is not, as many suppose, a limitless expanse of undulating, blistering sand. As a matter of fact, few other regions present more interesting scenery. It is true, however, that much of its surface is sandy, particularly in the north, where it resembles a frozen sea of sand broken here and there by old mountains which have been worn down by centuries of weathering.

Most of the Sahara is a plateau more than 1,000 feet above sea level. This elevation runs from northeast to southwest and is crossed by three mountain ranges—the Tibesti, the Air, and the Ahaggar—varying in height from 6,000 to 8,000 feet and snow-topped in winter. At other points



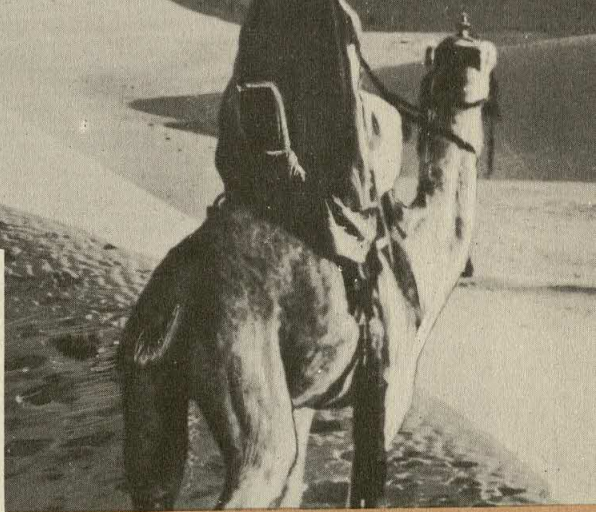
the wind has hollowed out the sand until craters below sea level have been created. The most desolate areas of the Sahara lie in Libya, with its long stretches of barren, trackless sand, bereft of life and vegetation. The greater portion of the western part of the desert is French West Africa.

Life in the Desert. Were it not for the oases in the desert, life on the Sahara would be well-nigh impossible. Camel caravans are so routed that these watering places are regular stops. Around the oases are settlements. Date palms grow there in abundance. Barley, wheat, millet, cotton, and fruit are raised; and herding thrives. The Sahara's known natural resources are salt, coal, oil, and phosphates.

Sahara winters last but four months, the summers eight. Although the winter months bring considerable rainfall, the water never collects into rivers, but runs short distances and gradually sinks into the sand. Day temperatures in the summer often reach 120°F., followed by cool nights. At times, even freezing temperatures occur.

Few wild animals are to be found, except near the fringe of the desert and near the oases, where lions, panthers, wolves, hyenas, foxes, and jerboas abound. The camel is the most important of the domestic animals, although sheep, cattle, horses, donkeys, and goats are also raised.

The population is sparse, averaging less than one person per square mile. Through the central part roam the Tuaregs, fierce nomads; through the western part are scattered the Berbers; and to the east live Negroes and Bedouins.

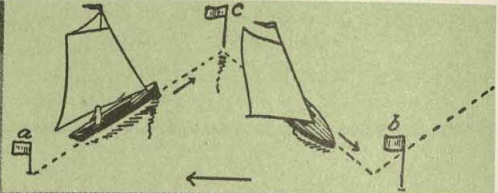


Philip Gendreau, N.Y.

A SEA OF SAND
Camels cross the rolling dunes of the Sahara.

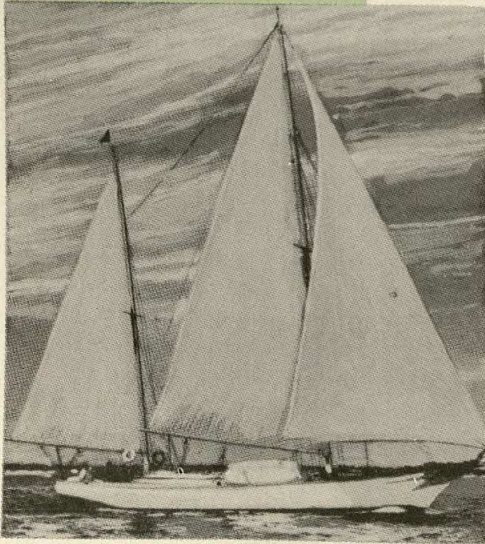
SAILBOAT AND SAILING. Steam and propeller have sealed the death warrant of the commercial sailing ship, but the adventurous call of wind and sail still lures man to seek sport and recreation on the water. On ocean bays and sounds, on the Great Lakes and other inland bodies of water, the sailing season annually brings more and more sailboats of all types to the water, their crews striving for victories in racing or enjoying the pleasures of cruising.

Construction of a Sailboat. A sailboat, as its name implies, is a boat propelled by the force of the wind on one or more sails. Its hull is generally elliptical; it has a keel, or centerboard, one or more masts, and a rudder. The keel or centerboard keeps the boat from moving sideways through the water when the boat is going in any direction except away from the wind. The centerboard is a keel which can be raised or lowered, and thus is useful on boats operating at times in shallow water. The keel or centerboard can also act as ballast—a counteracting force against the wind,



SAILS AND THEIR USE

Upper left, a fleet of sailing dinghies with typical catboat rigging (one mast set forward, one sail). Center, a Star boat, sloop-rigged (one mast, mainsail, and jib). Lower left, a ketch (main-masts and mizzenmasts, mizzen set forward of rudder post). Upper right, tacking (arrow represents wind direction).



which tends to tip the boat when coming from any direction except behind.

The sails, as a rule, are made of canvas and are held up by masts and stays. Their position depends on the direction the boat is traveling in reference to the wind. This direction is determined by the rudder, a flat surface extending below the water in the same plane as the keel. It is turned by the tiller, or steering wheel, and the pressure of the water against it when turned at an angle from the keel causes the boat to turn.

How the Boat Is Sailed. Designing sails and hulls properly requires a thorough knowledge of aerodynamics, the same science that is practiced by airplane designers. This science, comparatively new when one

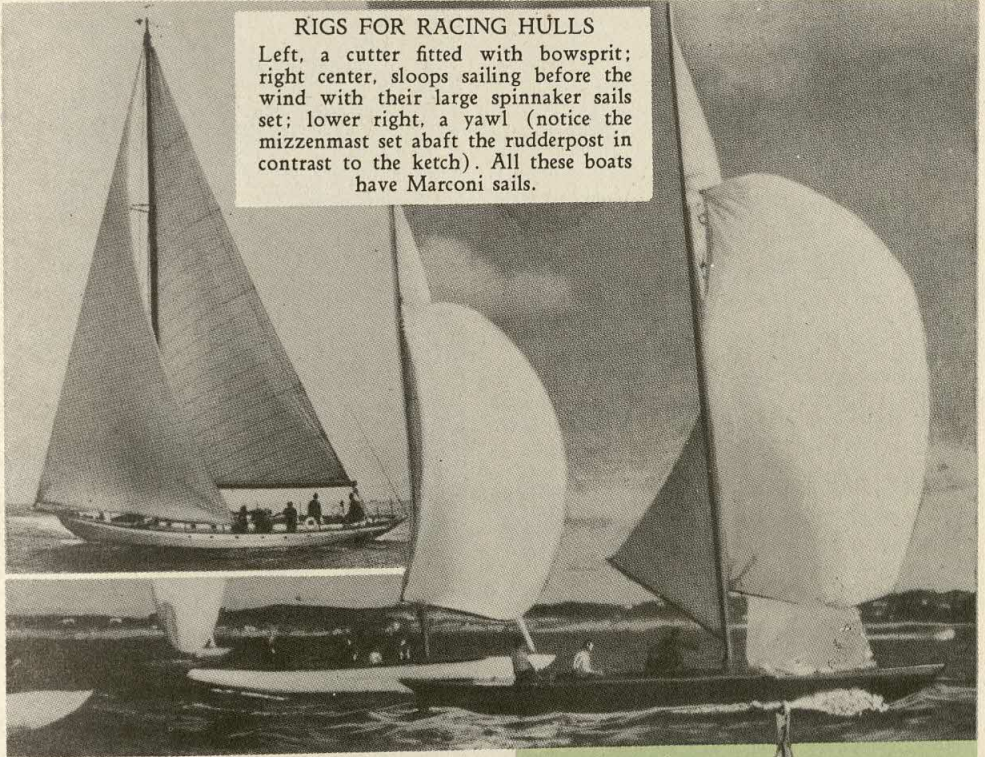
thinks of the centuries men have been sailing boats, has led to many changes in the designing of sails, for the wind acts upon a sail somewhat as it acts upon the cambered wing of an airplane. It is not difficult, of course, to understand how the wind propels a boat when the sails are spread at right angles to the wind; but to understand

sure of the wind on the sail area facing the wind.

Types of Boats. Most sailboats today are rigged fore and aft; that is, their sails extend in the same plane as the length of the boat. Old-time sailing ships were usually square-rigged, having four-sided sails strung from yards placed crosswise on the

RIGS FOR RACING HULLS

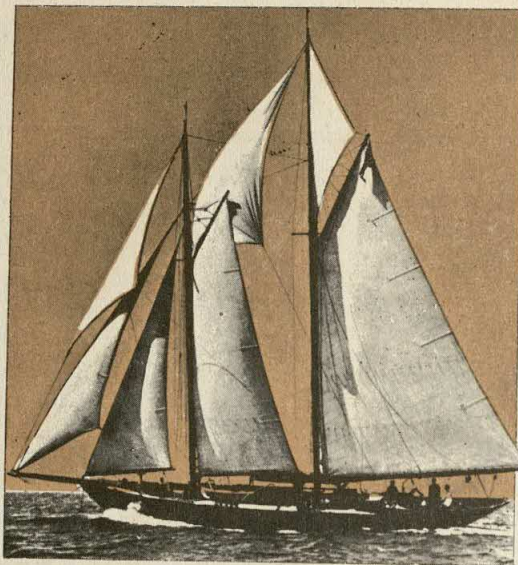
Left, a cutter fitted with bowsprit; right center, sloops sailing before the wind with their large spinnaker sails set; lower right, a yawl (notice the mizzenmast set abaft the rudderpost in contrast to the ketch). All these boats have Marconi sails.



the forces which permit a boat to sail east when the wind is from the north is more difficult. It is impossible for a sailboat to sail directly against the wind; but it is possible for it to sail in a general direction against the wind by a process known as tacking.

The boat, when tacking, is sailed at approximately a forty-five degree angle into the wind in one direction, then at the same angle in another direction; in general, it sails a zigzag course. In sailing in this manner, the vacuum created on the side of the sail away from the wind does as much to drive the boat forward as does the pres-





SPEED ON FOAM-FLECKED SEAS

Above, a gaff-rigged schooner (foremast and tall mainmast) flying mainsail, main topsail, foresail, jib, and staysails; upper right, a six-meter racing sloop out of the water, showing the sleek lines from bow to keel; lower right, an eight-meter sloop flying a Genoa jib.



masts. Modern sailboats may be cruising boats or racing boats, the difference being that cruising hulls are slower but roomier and more seaworthy. Sailboats range in length from 10 to 100 or 200 feet, and in design from boats with long, narrow lines and deep hulls to those of the broad, shallow type.

Both cruising and racing boats are sailed in races. By a complicated system, based on the sail area, length of water line, length over-all, weight, etc., the boats are handicapped. As the rules have changed, the designs of boats have altered with them to obtain the best results in races. The outcome has been the development of several one-design classes of boats, such as the Star-class boats, which are raced throughout the world. For inland lake sailing, flat-bottomed boats are popular, being extremely fast but usually unsuited to stormy weather.

Sailing Terms. Some of the terms used in sailing are: *windward*, the direction from which the wind is blowing; *leeward*

(nautical pronunciation *loo'ard*), the direction toward which the wind is blowing; *tacking*, sailing at windward angle; *starboard*, the right-hand side of the boat as one looks forward; *port*, opposite from starboard; *come about* or *go about*, to swing the boat into the wind and then around so that the wind strikes the sails on the opposite side from which the boat was sailing; *jibe*, the reverse of going about, swinging the boat around so that the wind passes around the stern; *halyard*, a line to raise and lower a sail; *sheet*, a line to control the angle of the sail to the wind; *stay*, a wire or rope supporting a mast or bowsprit; *block*, a pulley. See BOAT; YACHT AND YACHTING.

SAINT BARTHOL'OMEW, MASSACRE
OF. See BARTHOLOMEW'S DAY, SAINT.

SAINT BERNARD, *saN behr nahr'*, GREAT. Rising more than 8,000 feet above sea level, the Great Saint Bernard is a famous pass in the Alps between Italy and Switzerland. At the crest of the pass is located a mission, founded in the tenth century by Saint Bernard of Mentone to aid travelers crossing the mountains. The monks of the mission use specially trained Saint Bernard dogs to aid in rescue work. Through this pass, Napoleon's army marched into Italy in May, 1800.

Little Saint Bernard. The Alps south of Mont Blanc and a smaller pass are called Little Saint Bernard. The pass, which is 7,177 feet above the sea, also has a hospice founded by Saint Bernard. As in Great Saint Bernard, a fine auto road now follows this easiest pass through the Alps. See SAINT BERNARD DOGS.

SAINT BERNARD, *sante bur nard'*, DOGS. Few, if any, breeds of dogs are more entitled to the affection of man than the Saint Bernard. Time and again, dogs of this breed have saved the lives of men, usually those lost in snowstorms. One Saint Bernard had a record of having saved forty persons who had become lost in the Alps.

The name comes from that of the Hospice of Saint Bernard, where the monks have raised and bred these dogs since the Middle Ages, to help travelers in the mountains. The dogs are enormous animals with sober faces, more or less mournful eyes, and the kindest of dispositions. They may be either long-haired or short-haired creatures, and are orange and white in color. Their deep voices may inspire fear in marauders, but the animals usually distinguish friend from foe. These dogs welcome the attentions of their masters and of strangers, but with a greater dignity than would be possible to a smaller dog.

SAINT CLAIR, ARTHUR (1734-1818). A Scotsman by birth, Arthur Saint Clair loyally served the American nation. He came to America during the French and



Keystone

FOND FAREWELL

Construction of all-season Alpine passes caused the retirement of the Saint Bernard.

Indian War, when he took part in the campaign against Louisburg and Quebec. After the war ended he settled in Western Pennsylvania; but when the Revolution broke out, he became brigadier general of the state militia and helped to organize the New Jersey troops that fought at Princeton and Trenton. In 1777, after being made a major general, Saint Clair was placed in command of Fort Ticonderoga, which he surrendered to General Burgoyne. He was court-martialed for this action, but was acquitted and went South, where he fought with General Greene.

After the war Saint Clair was elected to the Continental Congress, and in 1787 became president of that body. Two years later he was appointed the first governor of the Northwest Territory, and was made commander in chief of the army in the territory in 1791. In an unfortunate campaign against the Miami Indians, his forces were badly defeated, and he resigned in 1792.

SAINT GAUDENS, *gaw'denz*, AUGUSTUS (1848-1907). The most outstanding of American sculptors, Augustus Saint Gaudens, more than any other artist, was responsible for the development of sculpture as a fine art in the United States. His heroic statues of historical figures, as well as the painstaking workmanship and beauty of his low-reliefs, won him world-wide fame. Notable among his sculptures are the statues of *Sherman* and *Admiral Farragut* in New York; the *Shaw Memorial*, Boston; *Lincoln*, Lincoln Park, Chicago; and the *Adams Memorial*, in Rock Creek Cemetery, Washington, D. C. His low-reliefs include those of *Bastien-Lepage* and *Robert Louis Stevenson*.

Saint Gaudens was born in Dublin, but his family came to America when he was only three months old. He received his first artistic training as an apprentice to a cameo cutter. When a young man he spent some time studying in Paris and Rome. *Hiawatha*, his first statue, was completed in Rome.

SAINT GEORGE AND THE DRAGON. Events in the life of Saint George, England's patron saint, have been celebrated in painting, song, and legend. The most famous of the legends is the tale of the slaying of the great fire-breathing dragon. The story symbolizes the conquest of Christianity over paganism.

According to the old story, this fiery monster demanded human sacrifices. The demand was obeyed until, one day, Saint George met a procession led by the king's daughter, who was to be sacrificed. Saint George destroyed the dragon with his sword, and then, announcing that he had been helped by the power of God, he urged the people to cease their pagan worship and turn to Christianity. Edward III of England made Saint George the patron of the Knights of the Garter, and one of the insignia of the order shows the killing of the dragon. The cross of Saint George appears in the British flag. Catharine II created the Russian Order of Saint George in 1769. In the Louvre, Paris, there is a fam-

ous painting by Raphael depicting the slaying of the dragon. See **GEORGE**, SAINT.

SAINT GERMAIN, *saN zher man'*, TREATY OF. At the end of World War I, Austria and Hungary had each declared themselves to be independent republics, and the Allied Powers recognized them as such, dealing with each separately in drafting the peace treaties. The agreement with Austria, known as the Treaty of Saint Germain, was signed at Saint Germain-en-Laye, a small town near Paris, on September 10, 1919. In this treaty territory formerly belonging to Austria-Hungary, with a German population of nearly 4,000,000, was assigned to Italy and to several newly formed states. Italy received South Tyrol, Trentino, Trieste, and Istria; Bohemia, Moravia, and other territory went to Czechoslovakia. Poland, Rumania, and Yugoslavia each received parts of the old Dual Monarchy.

Among other provisions of the treaty was one which prohibited Austria from uniting with Germany except with the unanimous consent of the Council of the League of Nations. As in the other peace treaties, Austria was obliged to accept responsibility for the First World War. Austria was united with Germany from 1938 to 1945, in defiance of treaty obligations.

SAINT GOTTHARD, *saN go tahr'*. Situated in the Swiss Alps are the Saint Gotthard Mountains, connecting the Lepontine with the Bernese Alps. The highest elevation in this group is Pizzo Rotondo, which rises 10,490 feet above sea level. A great engineering feat was the construction of a railway tunnel under the Saint Gotthard Pass, connecting Italy and Switzerland. This tunnel is more than nine miles long, and at its highest point is 3,786 feet above sea level.

SAINT HELENA, *sante hel e' nah*. This tiny British island of forty-seven square miles is located 1,200 miles off the west coast of Africa. It was the scene of Napoleon's exile after his defeat at Waterloo. The island is rugged and unproductive, but has a moderate, healthful climate. Only

a small part is suitable for cultivation; potatoes and flax are the most important products. The population of about 4,000 is made up chiefly of Europeans and Africans. Jamestown is the port and only town of Saint Helena.

SAINT LAWRENCE, GULF OF. A vast inlet of the North Atlantic Ocean, the Gulf of Saint Lawrence lies between Newfoundland on the east and New Brunswick and Nova Scotia on the west. It is of great commercial importance because it forms the entrance to Canada's largest inland water route. Fishing is carried on extensively in its waters. The gulf merges with the estuary of the Saint Lawrence River at its western end. It is connected with the Atlantic by three channels—the Strait of Belle Isle, located between Newfoundland and Labrador; the Strait of Canso, between Cape Breton and Nova Scotia; and Cabot Strait, between Newfoundland and Cape Breton. In the gulf are a number of islands, the largest of which are Prince Edward, Anticosti, and Cape Breton. The gulf was discovered by Jacques Cartier in 1534 (see CARTIER, JACQUES).

SAINT LAWRENCE RIVER. Draining an area of over 500,000 square miles, including the entire Great Lakes region, the Saint Lawrence River, located in South-eastern Canada, is of vast commercial importance. It forms the entrance to a great, continuous seaway running from the Atlantic Ocean to Lake Superior. The river emerges from Lake Ontario and flows northeasterly for a distance of 760 miles to the Gulf of Saint Lawrence. Below Lake Ontario it is four to ten miles wide, and here are located the beautiful, wooded Thousand Islands. Gradually broadening as it leaves the city of Quebec, the river enters the Gulf of Saint Lawrence as an estuary ninety miles in width.

The river is navigable for large, ocean-going steamers as far as Montreal. Beyond Montreal, it has been extensively canalized around rapids and falls to permit the passage of smaller vessels; and for these light steamers the Saint Lawrence affords con-

tinuous passage from its mouth to Lake Ontario. Navigation through the other Great Lakes is made possible by eight canals, totaling seventy-three miles in length. The two most important of these canals are the Welland, between lakes Ontario and Erie, and the Sault Sainte Marie, or "Soo," on Saint Mary's River, between Lake Huron and Lake Superior. See SAINT LAWRENCE WATERWAY; SAULT SAINTE MARIE CANAL; WELLAND CANAL.

SAINT LAWRENCE WATERWAY. A system of rivers, channels, canals, and lakes forming a water route from the mouth of the St. Lawrence River to the western shores of the Great Lakes, providing a direct route from the Atlantic Ocean to ports on the Great Lakes. The distance from the Atlantic Ocean to Duluth at the western end of Lake Superior is 2,342 miles. The main routes are the St. Lawrence and the Great Lakes, including the Lachine, Soulanges, Cornwall, Farran Point, Rapide Plat, and Galop canals on the St. Lawrence, the Welland ship canal between Lake Ontario and Erie, the Sault Ste. Marie canal between Lake Huron and Superior, and canals and branches on the Richelieu and Ottawa rivers connecting Georgian Bay with Lake Ontario.

Although the water route from the sea to the Great Lakes had been used since the early explorations of North America, a continuous route was not available until April 25, 1959, when the St. Lawrence Seaway was opened. The project was started in 1954 when Canada and the United States agreed to build new canals and locks, deepen the existing channels, and develop new hydroelectric power sites on the St. Lawrence. The seaway cost \$500,000,000, and took five years to build. It is 400 miles long. It is operated and maintained by the St. Lawrence Seaway Development Corporation, a U.S. Government corporation, and the St. Lawrence Seaway Authority of Canada. See SAINT LAWRENCE RIVER.

SAINT LOUIS, *loo'is*, Mo. Metropolis of Missouri, largest city on the Mississippi River, Saint Louis is tenth in size in the



St. Louis Chamber of Commerce

METROPOLIS ON THE MISSISSIPPI

Bounded by tall buildings, the Memorial Plaza is an island of beauty in downtown St. Louis.

United States. Built on the west bank, it has spread along the river in the shape of a half moon for a distance of nineteen miles. The city's population is about 750,000.

The city has had a colorful story. Once, the cobblestones of the long levee resounded with the clatter of carts and wagons and the shouts of hurrying roustabouts. River packets by the score tied up at busy wharves, and the bustle and life of the fast-growing metropolis reflected the spirit of expanding and westward-bound America.

Saint Louis was the gateway to the West and Southwest for the people who came overland from the East. The city was also the depot for the cotton shipped north from Louisiana, Mississippi, Texas, Arkansas, and Tennessee. The goods of the East, West, North, and South crowded the city wharves, and Saint Louis became an important distributing point for the nation. With the building of the railroads, it became a great railroad center.

As the industrial life of the city quickened, shoe factories were built; fur and brewing establishments and factories for the manufacture of clothing, tobacco, chemicals, and hardware were located there. Later, automobile plants were erected

in the city, and retail and wholesale business boomed. It became a grain and livestock center and seat of the Eighth Federal Reserve District offices.

In the course of this varied development, Saint Louis became a city of contrasts. Such buildings as the Old Court House, where the historic Dred Scott Case was tried, mingle with many fine modern structures. The city, seat of a Protestant Episcopal diocese and a Roman Catholic archdiocese, is noted for its churches.

Memorial Plaza, honoring heroes of World Wars I and II, is surrounded by imposing structures, including City Hall, the Civil Courts and Federal buildings, and Kiel Auditorium, with its large opera house and convention hall. Nearby is the main public library. Adding to the city's charm are tree-lined boulevards and 3,000 acres of parks, including Forest Park, with its world-famed zoo, open-air theater, Art Museum, and Jefferson Memorial. Also noted are the city's great hospitals and educational institutions, including Saint Louis and Washington universities. Near the enormous Union Station is the "Wedding of the Rivers," a handsome fountain by Carl Milles. Another showplace is the Missouri Botanical, or "Shaw's," Garden. Historic Eads Bridge and numerous other bridges span the broad Mississippi River at Saint Louis.

Saint Louis traces her history back to 1764, when Auguste Chouteau, acting for Pierre Laclede Liguette, founded a fur-trading station on the site. It was named in honor of Louis IX of France, although the territory was ceded to Spain in 1770. Ceded back to France in 1800, the territory west of the Mississippi became American in 1803 with the Louisiana Purchase. Saint Louis was then an important frontier post. In 1804 Lewis and Clark made their expedition into the Louisiana Territory, and the westward trek of settlers to Saint Louis and beyond began. In 1904 a world exposition was held in Saint Louis to celebrate the hundredth anniversary of the Louisiana Purchase.

SAINT MARK'S CATHEDRAL.

Named for the patron saint of the city of Venice, Saint Mark's is one of the world's most ornate cathedrals. The structure, about 250 feet long and 170 feet wide, faces east on the celebrated Square of Saint Mark's. Originally built in 830, the cathedral was destroyed and rebuilt in the year 976. Again destroyed by fire, it was reconstructed in the eleventh and twelfth centuries, following the Byzantine style. Gothic additions were added in the fifteenth century, and in 1807 the church was elevated to the rank of a cathedral.

As unusual as it is beautiful, the cathedral is readily seen to be a composite of several styles of architecture. It is built in the shape of a Greek cross, with its center and arm extremities surmounted by massive domes. The roof is composed of numerous mosquelike cupolas. Five doors open into the front of the church, and over the central door are five colossal bronze horses, which were brought from Constantinople. The interior, finished almost wholly in mosaic, contains dozens of beautiful marble statues of holy figures. Many curios and bronzes, dating from the fourteenth and fifteenth centuries, make Saint Mark's an entrancing museum as well as a magnificent place of worship. Near the church is a beautiful bell tower. See CAMPAÑILE; VENICE.

SAINT MARY'S RIVER. Extending for forty miles between Lake Superior and Lake Huron, and forming part of the boundary line between Ontario and Michigan, this short river has become one of the most important commercial waterways in the world. It is the route followed by hundreds of lake freighters and barges which transport many tons of grain, chiefly wheat, and great quantities of iron ore. At Sault Sainte Marie, on both the American and Canadian sides of the river, a system of locks allows boats to pass around the rapids which interrupt navigation at that point. See SAULT SAINTE MARIE CANAL.

SAINT PATRICK. See PATRICK, SAINT.



Associated Press

SITE OF WORSHIP AND BEAUTY

St. Mark's Cathedral in Venice is often a place for festivals as well as prayer.

SAINT PAUL, MINN. Situated on the high, terraced bluffs along the eastern and northern banks of the Mississippi River is Saint Paul, the capital and second largest city of Minnesota. With Minneapolis, it forms the famous "Twin Cities" which serve as the gateway to the great Northwest. Saint Paul covers an area of about fifty square miles, which lies mostly north of the Mississippi, as the river swings eastward in a double curve and then southward again. South and West Saint Paul, which lie south of the river as it bends, are included as part of the city. The population is about 317,000.

Saint Paul is a modern city, with fine buildings and wide boulevards. On the lowest river terrace are the wharves, railway yards, and wholesale districts; the main business center of the city is situated on the second level, where retail stores and hotels are located; and the residential districts occupy the highest level. A fine air-

port is located along the river, where hydroplanes can anchor. There are several large river bridges.

Outstanding among the buildings of the city is the marble capitol, with a great white dome that rises 220 feet above the ground. There are a number of large bank buildings and several imposing churches, finest of which is the Roman Catholic Cathedral of Saint Paul. Among several well-known educational institutions are Hamline University, Macalester College, Saint Paul Theological Seminary, College of Saint Thomas, and the Saint Paul College of Law. The Agricultural College of the University of Minnesota lies near the city.

Saint Paul is noted for its beautiful and well-kept park system, which has a total area of 2,250 acres. The largest include Phalen Park, Como Park, with botanical gardens and a zoo, Indian Mounds Park, the Municipal Forest, and Harriet Island.

Saint Paul is an important industrial city. The largest manufacturing plant is that of the Ford Motor Company. Much of the power for the city's factories comes from a Federal hydroelectric dam, built on the river near the Ford plant. The city has the country's largest plant for the manufacture of hoisting machinery, the largest law-book publishing house, and the largest establishment manufacturing advertising specialties. It is also an important fur center. South Saint Paul is an important livestock market.

The first white people to visit the site of Saint Paul were probably a group of French fur traders who went there in 1658. Father Hennepin, the Jesuit missionary, was there in 1680. Following the Louisiana Purchase, Lieutenant Zebulon M. Pike, who in 1805 had been sent on an expedition to claim the territory, purchased from the Indians the land on which Fort Snelling was later built and where Saint Paul now stands. He paid \$2,000 in cash, appropriated by Congress, sixty gallons of whisky, and various articles prized by the Indians.

In 1841 Father Lucien Gaultier built a log chapel there and named it Saint Paul's.

The place was called Paul's Landing before it received its present name. It was made the capital of the territory of Minnesota in 1849, was incorporated as a city in 1854, and in 1858 became the capital of the state. Saint Paul has adopted the commission form of government.



WREN'S MASTERPIECE

Christopher Wren laid first stone of Saint Paul's, set the last thirty-five years later.

SAINT PAUL'S CATHEDRAL. The most famous Protestant cathedral in all Christendom is picturesque old Saint Paul's in London, completed in 1710 under the direction of Sir Christopher Wren. One of Europe's most imposing domed structures, it towers to a height of 360 feet, with its pinnacle surmounted by a stone lantern and a cross. Chiefly Renaissance in style, the structure follows the English Gothic church in its proportions.

It is said that at one time there was a Roman temple where Saint Paul's now stands. The first Christian church on this site was built in 610 and destroyed by fire in 1087. It was replaced by Old Saint Paul's, which was razed in the great London fire of 1666. The present church was begun in 1675 and required thirty-five years to complete. Like Saint Mark's of Venice, the edifice shows several architectural influences—Gothic, Italian, and British.

The interior is unusually impressive, with its view down the long nave into the choir. An interior dome breaks the dis-

tance to the great outer-dome pinnacle. Saint Paul's was bombed in World War II.

Here are buried many of England's most famous personages, including the architect, Sir Christopher Wren, and Wellington, Nelson, Moore, Barry, and Lord Salisbury.

SAINT PETERSBURG, RUSSIA. See LENINGRAD.

SAINT PETER'S CHURCH. Largest and most famous of the Christian houses of worship, magnificent Saint Peter's Church at Rome stands on the spot where Saint Peter is believed to have been buried, and where, in ancient days, many Christians were persecuted by pagan Roman emperors. To the right of the church is the Vatican Palace.

The first building to occupy the site was a great basilica erected in the fourth century. In the fourteenth century, when the Popes resided in Avignon, the structure deteriorated. Pope Nicholas V, in the fifteenth century, decided to build a new edifice, but little progress was made until the reign of Pope Julius II (1503-1513). The first plans were drawn by the famous architect, Donato Bramante, and the foundation was laid in 1506. The work was continued under various architects, including Michelangelo, and the church was dedicated in 1626 by Urban VIII.

The structure, in the form of a Latin cross, has an outside length of 727 feet, and its height, from the ground to the top of the dome, is over 400 feet. Over the altar is suspended a resplendent bronze canopy ninety-five feet high. Splendid marble statuary, costly mosaics, colorful marble columns, and fine paintings are scattered throughout its impressive, massive interior. In the oval piazza in front of the church stands a magnificent, red-granite obelisk built of Egyptian stone; here also are two of the most beautiful fountains to be found in Rome. See **ROME**.

SAINT PIERRE, *saN pyare*, AND MIQUELON, *mek' lawN'*. The only possessions of France in North America are two small groups of islands; the two largest islands are Saint Pierre and Miquelon, ten

miles south of Newfoundland. Barren and unproductive, they cover an area of about ninety-three square miles. The chief occupation of the people, who number about 4,000, is cod fishing on the near-by Grand Banks. The French occupied the islands in 1660. The islands passed back and forth between the French and the English until 1814, when the French gained possession and retained it until 1941. The Free French forces took possession of the islands during World War II.

SAINT SOPHIA, *so fe'ah*. Just as Saint Paul's and Saint Peter's are outstanding in the Christian world, so Saint Sophia is a famous mosque in the realm of Mohammedanism. It is Istanbul's (Constantinople's) dominant structure, and the supreme example of Byzantine architecture. It was begun by the Roman emperor, Justinian I, in 532 and dedicated in 538.

Saint Sophia is almost square-shaped, with approximately 243 feet to a side. Its chief hall is a large nave, 243 feet long and 107 feet wide. The structure is capped by a massive circular dome 180 feet high and 107 feet across. Light enters through windows built around the base of the dome. The interior walls are exquisitely decorated with mosaics, marbles, and alabaster. All Christian emblems were removed from the walls when the place was taken over by the Mohammedans, in 1453, and the mosaics were covered with whitewash. Under the direction of the present Turkish government these mosaics are being uncovered, and the mosque is now regarded as a museum of Byzantine art. An attempt was made to rename the building Mosque Mehmedie, in 1923, but the older name persists.

SAINT THOMAS. One of the Virgin Islands, Saint Thomas is located east of Puerto Rico in the Caribbean Sea. It comprises a total area of thirty-three square miles, and supports a population of 16,000, mostly Negroes. Saint Thomas, the chief city and capital of the island, is situated on a fine harbor, and is an important coal- ing station.

SAKHALIN, *sah kah leen'*. Situated in the Pacific Ocean just off the coast of Siberia is the long mountainous island of Sakhalin. The island covers an area of 27,823 square miles. There are heavily timbered areas on the mountain slopes, several important oil fields, and large coal deposits. Fish are plentiful in the short, fast-flowing streams, and fur-bearing animals are found in large numbers. Agriculture is not well developed because the soil is thin and poor. Russia controlled the entire island until 1905, when Japan acquired the southern half because of her victory in the Russo-Japanese War. Japan held the whole island briefly, during World War I, but later retired south of the fiftieth parallel. She lost her half of the island in 1945, when she surrendered in World War II.

SAL'AMANDER. Unlike the lizard, which it resembles superficially, the salamander can live both on land and in the water. All salamanders begin life in water, and some live there permanently. Like frogs and toads, salamanders are amphibians (see AMPHIBIANS), but belong with newts to the tailed members of that group. The salamander has a moist, scaleless, slender body, four clumsy legs, and a pointed tail. Salamanders lay their eggs in the water, and the young are equipped with gills, which they retain for a long time. The species that take to the land usually live under logs and stones, feeding on snails, worms and insects.

SALE. When a person makes a purchase and gives in exchange something considered of equal value, a sale has been made. In making a sale, money is commonly used as the medium of exchange. Sometimes certain goods may be given for other goods, but this kind of transaction is usually called *barter*.

In selling personal property, the sale is complete when a *bill of sale* or a *receipt* has been given to the buyer by the seller, showing that no further obligations are connected with the transfer. When real estate is sold, a *deed* is given to the buyer when he acquires title to the property. If

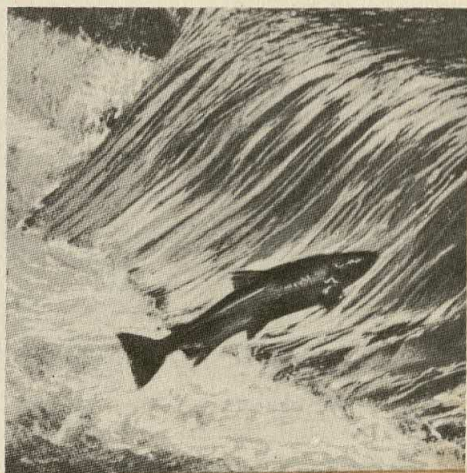
the payment is not complete, the buyer holds a *mortgage* for the unpaid balance. See **DEED**; **MORTGAGE**.

A sale can be made for articles which are to be delivered in the future. Such sales are made in transactions involving futures in stocks and commodities.

SA'LEM, ORE. Situated on the Willamette River is Salem, capital of the state of Oregon. A small but important city, it lies in the heart of one of the most productive agricultural regions in the United States. It is a modern city with wide, shaded streets and several imposing buildings. Among the more outstanding structures are the Oregon State Capitol, Federal building, city hall, Public Service Building, and State Highway Building. Included in the numerous public and private institutions are Willamette University, four libraries, a government Indian school, several charitable institutions, and the state penitentiary.

The city owes its growth and prosperity to the rich farm lands that surround it. Salem serves as the distributing point for fruit, wheat, long-fiber flax, lumber, and hops. Industrial products include machinery, foundry products, woolens, lumber products, flour, and canned goods. Salem was chartered as a city in 1853 and became the capital of Oregon in 1860. The population is about 50,000.

SALI'VA. A thick, cloudy fluid secreted by the salivary glands, saliva is an important aid to digestion. It not only moistens the food to make swallowing easier, but it also contains an enzyme, *ptyalin*, which converts starch into sugar. There are three main groups of salivary glands—the *parotid*, on the sides of the throat; the *submaxillary*, under the edge of the lower jaw; and the *sublingual*, under the tongue. There are also a number of small mucous glands in the mouth which excrete saliva. The flow of saliva is started by the sight, taste, or smell of food; by the mastication of food; and also by certain emotions, diseases, drugs, and electricity. The normal secretion of saliva is two to three pints daily.



Left, courtesy American Can Co.

THE KING OF FOOD FISH

Above, left, "brailing" salmon from a Pacific-coast trap. Top, right, the fish are able jumpers when impelled to travel upstream to spawn. Below, yolk sac of young.

SALMON, *sam'un*. The salmon of the Atlantic and the salmon of the Pacific are two different fishes. They are much alike in appearance, but very different in habits, and their differences have an important bearing on their value as food.

The Pacific Salmon. Because of its peculiar life habits, the salmon of the Pacific coast of America has become one of the most important food fishes of the world. The annual pack of Pacific salmon for the United States and especially for Alaska, which is noted for its salmon, is worth millions of dollars. Other millions of dollars' worth of the fish are taken each year by Canadian fisheries.

The peculiarity of this fish is that it is hatched in rivers, goes to sea when still young, and stays there for a period, thought to be four years, then returns inland to spawn and die. At spawning time it makes its way upstream at a rate of two, three, four, or more miles a day. In the Yukon some salmon ascend over 2,000 miles; in shorter rivers such as the Columbia and

Fraser, they may reach the headwaters. They are discouraged by no obstacles; if one cannot leap a waterfall it will keep trying until it batters itself helpless. During the ascent of a river the fish do not eat, and, so far as is known, none has the strength to return to the sea when the spawning season is over.

At spawning time, salmon enter rivers in such numbers that they are easily taken in nets and traps. Some varieties frequent only snow-fed rivers, other prefer rivers flowing out of lakes. The time for their *running* seems to be determined by the flowing of cold waters into the ocean. Thus, those that enter snow-fed rivers start in spring, the others in fall. The fish that run in spring are best for food, because they start while in good flesh. Fall runners are leaner, and as spawning time approaches, their flesh becomes pale and dry.

The five principal varieties of Pacific salmon, in the order of their food value, are: first, *chinook*, also called *king*, *quinnat*, *tyee*, and *red spring*; second, *sockeye*, also

known as *red*, *blueback*, and *sukkegh*; third, *coho*, also called *silver* and *silver-sides*; fourth, *humpback*, also called *Alaska pink*; and fifth, *chum*, also called *dog*, *calico*, and *keta*.

Nearly all of the Pacific salmon catch is canned for consumption in the United States, Canada, England, the Philippines, Mexico, Australia, and other countries. But several million pounds are sold fresh, frozen, "mild-cured," pickled, dry-salted, dried, and smoked. Salmon oil and salmon fertilizer are also commercial products.

The Atlantic Salmon. The salmon of Maine and Eastern Canada is the original, or true, salmon and is of the same genus as the trout. In the market it is sometimes called *Kennebec* salmon, to distinguish it from Pacific salmon. The Hudson and other streams in the East were salmon rivers in colonial times, before the days of sewage and manufacturing wastes. Efforts are being made to purify these streams and to make them safe for fish.

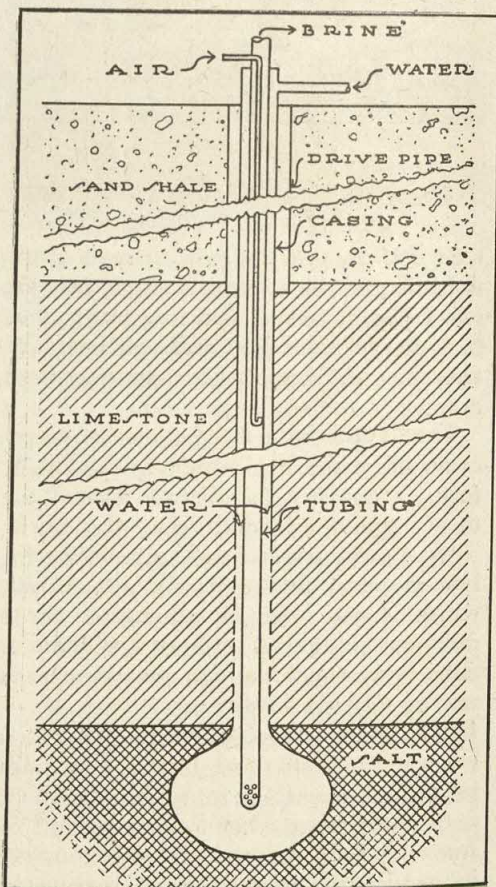
The salmon of the Atlantic spend a part of their lives in the sea. They may run up rivers to feed, and always do so at the breeding season. They lay their eggs in shallow, swift water, commonly in the fall. These eggs hatch in the spring.

The Atlantic salmon may reach a weight of more than eighty pounds, but usually weighs less than fifteen pounds. Its flesh is like that of the chinook, and is usually eaten fresh or is frozen. See FISH AND FISHERIES.

SALON, *sa lawN'*, THE PARIS. Held each year during May and June, in the Palais des Beaux-Arts, the Paris Salon is an exhibition of the works of living artists. Paintings, etchings, engravings, and pieces of sculpture are entered. A committee chosen by the exhibitors, the Society of French Artists, selects the works to be exhibited, and awards medals and the highest prize of all, the *Prix de Rome*. An independent organization, the National Society of Fine Arts, also known as the New Salon, holds an annual showing from May through July.

SALT. A very common mineral, salt occurs in small quantities almost everywhere, and in vast quantities in many places. It is a chemical compound of sodium and chlorine. Sodium is a soft metal like lead, and chlorine is a yellow, poisonous gas—the first gas used by the Germans in World War I. The compound of the two is scientifically known as sodium chloride and is the familiar substance seen as the fine, white, cubic crystals on every table.

In every gallon of sea water there is almost exactly one quarter of a pound of it. The total amount in the sea has been computed to be 4,500,000 cubic miles—about fourteen and one-half times the vol-



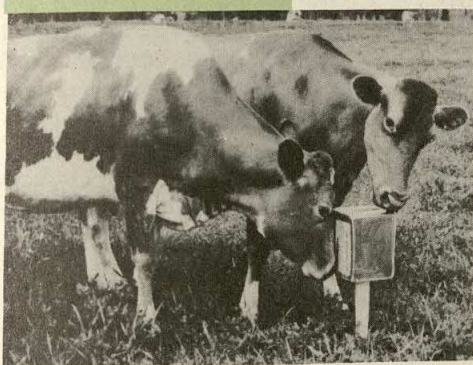
Courtesy Morton Salt Company

MINING SALT WITH WATER

This cross section of a salt well shows how water and air force the brine to the surface.

A COW LICK AND A CATHEDRAL OF SALT

Below, cows get a necessary part of their diet by licking mineralized salt blocks. Right, a salt mine on the Louisiana gulf coast, about 500 feet down. The deposit, 20,000 feet deep and 1,000 acres in area, contains salt enough to salt the world's food for 100,000 years.



ume of that part of the continent of Europe lying above sea level. About three and one-third per cent of the weight of sea water is salt. Some salt lakes contain greater percentages of salt than the sea, and the Dead Sea in Palestine contains six times as much.

Origin of Salt. All the salt in the world came originally from the weathering of rocks. Sodium is one of the chemical elements found in practically all igneous rocks, and is dissolved and carried by rains into the streams and then to the sea. At the same time other soluble substances are carried into the seas, so that sea water contains lime, magnesia, and potash, as well as common salt, which is about three fourths of the total dissolved matter. When sea water is evaporated, these various salts are left.

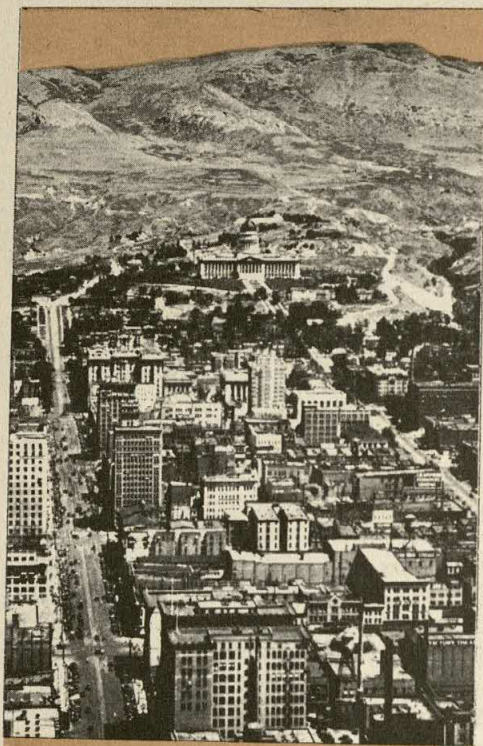
In past geologic ages, relatively shallow arms of the sea have been disconnected from the sea and their waters have been evaporated by the sun; thus great beds of rock salt have resulted. These beds have been covered by later beds of sand and

mud, so that some of them are buried under hundreds of feet of later sediments. Salt beds are often found associated with petroleum and natural gas.

Sources of Commercial Salt. Salt is obtained by artificial evaporation of sea water, by mining rock salt underground, just as coal or iron is mined, and by drilling wells into salt beds and dissolving the salt with water. This last method is the source of the largest production. The water pumped from the salt beds is evaporated and the solid matter left is purified to separate the lime, magnesia, potash, and other constituents. In arid countries much salt is made by evaporation of sea water; it is called *solar* salt because the heat of the sun is used. Some of this is important because it is cheap and because it is said to be better for salting fish.

The United States is the leading salt-producing country of the world, the output being nearly one fourth of the production of all countries combined. The five leading states are Michigan, New York, Ohio, Kansas, and Louisiana. There is also commercial production in California and Texas. Ontario is the principal Canadian province in salt production.

Grades and Uses of Salt. Salt is marketed by grades prepared for various uses. Table salt is very pure and fine-grained. It is sometimes mixed with starch or other substances to prevent its becoming damp. Dairy salt, packers' salt, coarse solar, pressed blocks, and rock salt are other grades.



THE MORMON CITY

Capital of Utah, Salt Lake City typifies the expansion of the West. It was founded in 1847.

Salt is used chiefly for seasoning and preserving food and in the chemical industries. In preserving meats, salt has only moderate preserving powers. When meat is smoked in addition to being salted, a much better result is obtained. The smoke preserves meat because of traces of formaldehyde and creosote. Salt is used dry or in brine. When meat is preserved in brine, a little saltpeter is used to give it a fresh pink tint (see SALTPETER).

Salt is used medicinally in several ways. As a warm-water solution it induces vomiting. It is injected in the blood in cases of serious loss of blood, and in the treatment of some diseases.

SALT LAKE CITY, UTAH. At the foot of the Wasatch Mountains near Great Salt Lake is Salt Lake City, headquarters of the Mormon Church and capital and largest city of the state of Utah. It lies in the center of a region noted for its scenic

beauty. It is also located in the heart of a rich mining and cattle area. The city is one of beauty, historic interest, and industrial importance.

Dominating the city is Mormon Square, about ten acres in area. It contains the Mormon Temple, the Tabernacle, and Assembly Hall. The Tabernacle is a large auditorium seating 10,000 people. The outstanding building is the Temple, which was built at a cost of \$4,000,000 and which took forty years to construct. Among the important public buildings are the Utah State Capitol, the county and city building, and the state penitentiary. There are numerous parks and playgrounds.

Salt Lake City has a number of institutions of higher learning, including the University of Utah, Rowland Hall, Westminster College, and libraries noted for their books about the West.

The chief industries are meat-packing, oil-refining, and the processing of ores. Other leading industries include canning, flour milling, sugar refining, and the manufacture of cement, machinery, foundry products, and dairy products.

Salt Lake City has a highly developed commerce, carried on chiefly by four trans-continental railroads. The city is also an air-line center.

After several years of hardship and persecution, a group of Mormons, under the leadership of Brigham Young, settled in the fertile valley at the foot of the Wasatch Mountains in 1847 and founded Salt Lake City. The city was incorporated in 1851 and was given its present name seventeen years later. With the discovery of gold and silver in the surrounding region, many people of other faiths migrated to Salt Lake City; now the Mormons make up less than fifty per cent of the population. The city has a population of about 190,000.

SALTPETER, or NITRATE. A white, crystalline powder resembling common salt, saltpeter is a compound of potassium, nitrogen, and oxygen, being known chemically as potassium nitrate. It is found in the natural state in the cave areas of

Tennessee and Kentucky, and in Egypt, India, Persia, and Spain, but for commercial purposes it is usually manufactured from Chile saltpeter (sodium nitrate) and potassium chloride. It is used with sulphur and charcoal in making gunpowder, as a meat preservative, medicinally, in dyemaking, as a flux in ore smelting, and in the manufacture of matches and fireworks. See **GUNPOWDER**.

SALVADOR, *sahl va daw'r*, or **EL SALVADOR**. On the Pacific side of Central America is the mountainous little country of Salvador. With an area of only 13,176 square miles, it is the smallest, most thickly populated of Central American republics. The country is crossed by two mountain ranges. These mountains rise from the floor of a high plateau, which slopes westward down to the low coastal plain, which has an average width of about fifteen miles. There are numerous volcanic peaks, the highest rising more than 8,000 feet. One volcano, Izalco, has been almost continuously active for more than a hundred years.

Among the rivers of Salvador the most important are the Lempa, the Paz, and the San Miguel. The Lempa flows through the entire country but is navigable for only small boats.

Climate. The climate along the coast and in the lowland districts is tropical. In the higher lands of the interior, however, temperatures are mild. Rainfall is plentiful in all parts of the country.

Industry and Commerce. Salvador has excellent, fertile soil, and most of the country is cultivated. Prosperity depends principally upon coffee, the most valuable crop and chief export. Other crops include sugar cane, cotton, henequén, rubber, tobacco, corn, rice, cacao, and indigo.

Salvador is rich in minerals, having large deposits of gold, silver, copper, lead, iron, and mercury. El Salvador is the world's only source of a balsam resin used in medicines and cosmetics. Fine lumber and dyewoods come from its forests.

There are only about 400 miles of rail-



United Nations

JAR VENDOR AND HIS WARES IN SALVADOR

The making of clay jars is an important craft in this Central American country.

way in Salvador. There are, however, some 1,500 miles of highway.

The People and Their Institutions.

With the exception of some pure Indians and a few foreigners, the people of Salvador are mestizos, or mixed Indian and Spanish. The language of the country is Spanish. Although there is freedom of worship, most of the people are of the Roman Catholic faith. A well-developed educational system provides free and compulsory education.

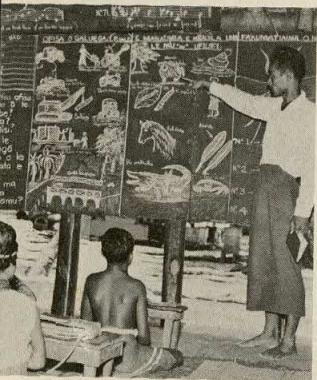
The total population is about 2,500,000. San Salvador, the capital, has over 203,000 inhabitants. Other cities include Santa Ana, San Miguel, Ahuachapan, and San Vicente.

Salvador is a republic headed by a President, selected for a term of four years, and assisted by a Cabinet of four ministers. The Chamber of Deputies is composed of forty-two members. In 1941, El Salvador declared war on Japan.

History. Alvarado, a lieutenant of Cortez, captured Salvador for Spain from the Indians in 1525. The city of San Salvador was founded in 1528. Harsh Spanish rule led the country to revolt in 1821, and Sal-



Ewing Galloway



Authenticated News

SERENE AS THE GREAT PACIFIC ITSELF

Above, life goes on cheerfully and contentedly in Samoa as shadowy forested mountains look down upon languid blue lagoons circled by slender wind-bent coco palms. Left, Samoan children go to a school that never needs heat.

vador then joined the Central American Federation. When the Federation became a part of Iturbide's Mexican Empire the next year, Salvador objected. In 1823, after Iturbide's fall, Salvador again joined the Central America Federation. In 1841 it officially became the Republic of Salvador. Its development and prosperity have been handicapped by the numerous wars it has had with other Central American countries. It has, however, become known as the most advanced of all the Central American republics.

SALVA'TION ARMY. From a humble mission established in London's East End in 1865, the Salvation Army has become one of the world's most powerful and influential religious and charitable organiza-

tions. Its purposes are twofold: the conversion of men and women to the principles of Christianity, and relief for the poor, jobless, and homeless. Into these two broad divisions the work of the Army is divided.

As a means of converting people to the Christian faith, the organization holds informal religious meetings, often in the open air, at which the teachings of Christ are explained in simple language. The work of the department of social welfare and relief consists of the establishment of slum settlements, industrial homes for the homeless, men's and women's hotels where the poor may find clean and sanitary lodgings, boarding houses for low-salaried workers, orphanages, assistance for released convicts, employment bureaus to find work for the jobless, soup kitchens, and many other charitable enterprises.

The Salvation Army is organized on a military plan in order to insure efficiency and discipline. The organization is under the leadership of a general, and the divisions of each country are headed by a commander. Other officers are given army terms, and promotion is gained through service. Uniforms of semi-military nature are worn.

Founded in 1864 by General William Booth, the Salvation Army was first called the Christian Mission. The present name

was adopted in 1880, the year the first branch was established in the United States. The organization has now spread to ninety countries, and maintains more than 16,000 Army posts. The present leader of the Army is General George Carpenter. The international headquarters are in London. See BOOTH (family).

SAMA'RIA. Of great historical significance in ancient Palestine was Samaria, capital of the northern Kingdom of Israel. Built by King Omri, the original city was named for Shemer, who owned the site (*I Kings*, XVI, 24). It fell into the hands of the Assyrians in 722 B. C., and about five centuries later was completely destroyed. It was later rebuilt by Herod, who termed it Sebaste, and today it is a village named Sebastieh.

SAMO'A, or SAMOAN ISLANDS. In the South Pacific about 4,200 miles southwest of San Francisco and 2,400 miles northeast of Australia are the Samoan Islands, formerly called Navigators' Islands. Fourteen in number, the islands have a total area of about 1,209 square miles and an estimated population of 118,200. Rugged and tropical, they contain a number of mile-high volcanic cones. Although hot, the islands are not unhealthful. Like many other tropical areas, they are frequently visited by violent hurricanes.

Before World War I, Samoa was controlled by Germany and the United States. In 1914 the German islands were taken by the British. A mandate of the League of Nations put the former German islands under the control of New Zealand.

Tutuila, Annuu, Rose, Swains, and the Manua group (Ofu, Olosega, and Tau) are the American islands. At Pago Pago, on Tutuila, there is a fine harbor used as a United States naval station.

Chief among the mandated islands are Savaii and Upolu, the latter the home of Robert Louis Stevenson for many years. He was buried on a hill overlooking Apia.

SAM'SON. In the *Book of Judges* is told the story of Samson, a man of God-given strength who was capable of killing

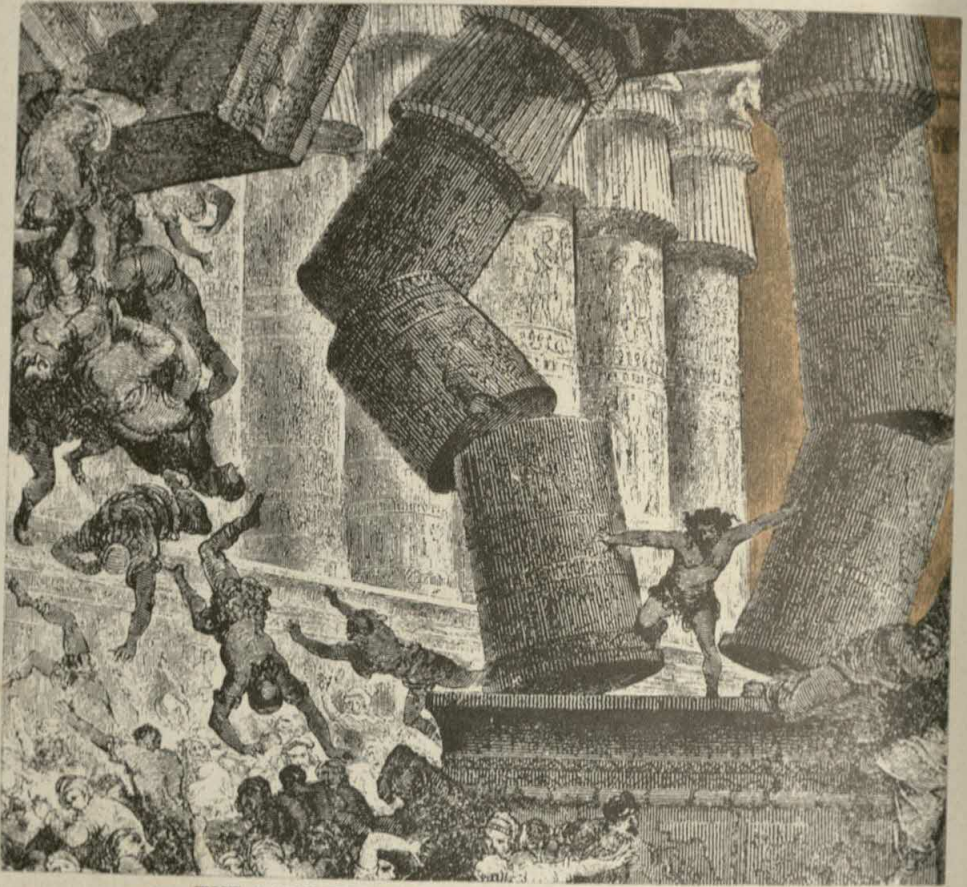
a lion by tearing its jaws apart and of slaying a thousand Philistines with the jawbone of an ass.

The Philistines, who were his enemies, made several attempts to end his life. Finally, a Philistine woman, Delilah, agreed to find out from Samson the secret of his power. She made several unsuccessful attempts, but finally discovered that his strength lay in his long hair. The reason for this was that Samson's mother had been told by Jehovah to bring him up a Nazarite—never to cut his hair or permit him to drink wine. Under Delilah's instructions, the Philistines cut off Samson's hair while he slept, and it was then easy to imprison and blind him.

While he was in prison, however, Samson's hair grew long again. While the Philistines were celebrating the festival of their god Dagon, they brought Samson to the temple to ridicule and mock him. Praying for divine help, he seized the supporting pillars of the building and brought down the roof upon his captors' heads, dying with them in the wreckage. The story also relates that he was a judge of Israel for twenty years.

SAM'UEL. The last man to rule ancient Israel in the epoch of the judges was Samuel, whose final duty was the anointing of the first Hebrew king, Saul. The story of Samuel is told under the heading BIBLE STORIES.

SAMURAI, sah moo ri'. During Japan's feudal period, the military, or warrior, class was called the samurai, a term which is derived from the Japanese word for *guard*. This class was composed of the *shogun*, or military commander in chief; the *daimios*, or feudal landowners, who exchanged military service for land; and the *samurai* proper, consisting of the swordsmen, gentlemen, and scholars. The feudal system existed in Japan until 1871, when it was overthrown. The daimios were given pensions by the emperor in return for the lands which they held, and later they became known as the nobility. The members of the samurai class were regarded as gentry.



THE LAST TRIUMPH OF ISRAEL'S "HERCULES"

Samson, mighty Biblical hero, avenged his captivity by the Philistines when he rent the pillars of the temple asunder, causing it to collapse. All perished, including Samson.

After the overthrow of the feudal system, most of the samurai turned to business and the professions, and it was the members of this class and their descendants who did much in bringing about the rapid advance of Japan in world affairs. See JAPAN.

SAN ANTONIO, TEX. The stirring epic of those who died in the Alamo in 1836 is only a part of the heritage of San Antonio, a key city of the Southwest. To her rich history may also be added the tales of courageous Spanish missionaries who settled on the San Antonio River in the eighteenth century; the adventures of daring Americans who came to the settle-

ment a century later; and the story of Texas oil, which has helped make San Antonio important commercially as well as historically.

Located in the important area of South-central Texas, San Antonio has developed into a vigorous, thriving city. Railroads spread out in every direction, and the city has become a vital distributing and shipping center, especially for goods coming to and from Mexico. Direct transportation to the Texas ports and the resource areas of the nation has given a great impetus to the city's industrial life, and today, steel and iron products, textiles, clothing, leather goods, flour, soap, cigars, and con-



Courtesy Southern Pacific Ry.

SYMBOLS OF SAN ANTONIO

Historic Alamo (above) and modern skyscrapers portray the spirit of a famed Texas city.

diments are manufactured in large quantities. Near-by oil and natural-gas fields add much to the wealth of the city.

San Antonio's location in a dry and comfortable climate has made it a fine health resort, especially for people from the North. It is an attractive city, with such historic buildings as the Alamo, San Fernando Cathedral, the Spanish governor's palace, and four ancient missions. The largest park, Breckinridge, covers more than 300 acres and contains numerous facilities for public recreation.

San Antonio's strategic importance is shown by the location nearby of such United States military posts as Fort Sam Houston, and Randolph, Kelly, Brooks, and Lackland Air Force bases.

The first settlement on the banks of the San Antonio River probably was made in the latter part of the seventeenth century, but it was not until 1716 that a mission was established. In 1835 the settlement was an objective of both Mexicans and Texans in the struggle for independence, and a year

later occurred the tragic massacre of the Alamo defenders. With a population of about 591,000, San Antonio ranks next to Houston and Dallas among cities of Texas. See ALAMO; TEXAS.

SAND. Material resulting from broken-down rocks, sand is made up of particles which range in size from that of a pinhead to that of a pin point. The broken-down rock material also contains many particles that are finer than sand, and others much coarser.

Sand particles are usually made up of the hardest parts of the rocks, since the softer parts break down to very fine particles. The mineral quartz which occurs in many rocks is very hard, and it is this mineral of which most sand particles are composed. As quartz is a light-colored mineral, pure sand is light in color. Pure sand is usually found along streams, or along the edges of the sea or large lakes, where it has been deposited by water. Practically all the sand used for building purposes has been sorted out from the finer or coarser particles by the action of water. Sand is also formed by the breaking down of a sandstone rock, although, as a rule, the material thus formed is not pure sand. It usually has some smaller particles mixed through it.

The use of sand in building and industry is very extensive, and deposits of proper purity and accessibility are exceedingly valuable.

The purest quartz sands are used in the manufacture of glass, as filters, for making mortars, and molds in foundries. The darker sands are chiefly used in the mixing of mortars and cements.

SANDALWOOD. Fragrant and useful, sandalwood is a product of several species of trees found in the East Indies and islands of the South Seas. The costly wood of the tree is manufactured into glove boxes and other ornamental objects and is burned for incense by the Brahman and Buddhist worshippers. The distilled oil of the tree is often used in perfumes and medicines, and usually sells for a high price. The *white* sandalwood, most com-

mon species, is a small tree which grows in India and near-by islands.

SANDBURG, CARL (1878-). Perhaps the most thoroughly American of all poetry has been written by Carl Sandburg, who first came into prominence with the publication of his *Chicago* in 1914. Like most of Sandburg's work, it is written in free verse, and in a forceful style which gives a definitely American color.

Since then the poet has written two groups of stories for children, *Rootabaga Stories* and *Rootabaga Pigeons*, and one of the great biographies of our time—*Abraham Lincoln: The Prairie Years* (1926). *Abe Lincoln Grows Up* was published in 1928, and the two books were issued in one volume in 1936. *The War Years*, published in 1939 in four volumes, won the Pulitzer Prize for the best historical work. In 1927, Sandburg produced *An American Songbag*, a collection of folk songs.

SAND'ERLING. Sometimes the bird known as sanderling is mistaken for the sandpiper. The sanderling, however, lacks the hind toe which characterizes the sandpiper. The head and neck are gray, marked with light streaks and spotted with brown; the breast and legs are white. Sanderlings breed in the Arctic regions of the world, migrating to the southern areas of South America, Africa, and the United States in the winter. They are often seen running through the shallow surf along the seacoast. See **SANDPIPER**.

SAND'PIPER. An active, graceful little shore bird, the sandpiper is a member of the snipe family. It is long-legged and has a slender body. With its long, thin bill, it probes about in the mud and sand for food. The general colors of sandpipers are gray, black, white, buff, and brown, duller in winter than in summer. The nests are built along rivers and seashores; three or four brown-spotted buff eggs are laid. Sandpipers migrate south in the winter.

The best-known North American species is the *spotted sandpiper*, or *teetertail*. Another species is the *Bartramian sandpiper*,



GRACEFUL BEACHCOMBER

Long-legged, but small, the sandpiper is a familiar sight along rivers and seashores.

often called the *upland plover*. Others are the *stilt sandpiper*, the *purple sandpiper*, and the *pectoral sandpiper*, or *grass snipe*.

SAND'STONE. In the latter part of the eighteenth century, the finest residences in our largest cities were "brownstone fronts," built of sandstone. Today sandstone is used chiefly in grindstones, whetstones, filters, linings for smelting furnaces, and rough stone work such as wells and foundations.

Most sandstone is made up chiefly of quartz sand cemented together by materials which have seeped into the sand in water. Mica, magnetite, and feldspar grains are often present in small amounts. Usually the cement is silica, the same material as the quartz grains, but iron oxide, clay, or limonite may form the cementing material. Sandstone varies in color from light gray or cream to dark brown or blue-gray, according to the nature of the cementing material. It is found in nearly every state, but more particularly in Ohio, Pennsylvania, Wisconsin, New York, West Virginia, and some of the Western states.

SANDY HOOK. Just south of Staten Island, N. Y., the coast line of New Jersey turns eastward, and at the easternmost extremity a narrow, low, sandy peninsula juts northward for a distance of six miles. Since all vessels entering New York Bay must pass near Sandy Hook, it is a hazard to navigation, and as early as 1762 a lighthouse was erected here.

